An Analysis of Female Representation and Marines' Performance in Aviation and Logistics Occupations

Jennifer Schulte with Aline Quester, Robert Shuford, and Catherine Hiatt

February 2016

CNA
ANALYSIS & SOLUTIONS

This document contains the best opinion of CNA at the time of issue.
It does not necessarily represent the opinion of the sponsor.

Distribution

Distribution unlimited. Specific authority: N00014-11-D-0323.

Copies of this document can be obtained through the Defense Technical Information Center at www.dtic.mil or contact CNA Document Control and Distribution Section at 703-824-2123.

Photography Credit: Beaufort, SC - SSgt Christine Mendenhall, 2nd Marine Aircraft Wing refrigeration electrician mechanic inspector from Newark, SC, inspects chain lifts on the wing of an F/A-18 Hornet with Sgt Tony Yates, Marine All-Weather Fighter Attack Squadron 224 hydraulic, pneumatic, structures mechanic from Covington, KY, during an Aviation Logistics Management Assist Team (ALMAT) evaluation aboard the Air Station on Sep. 10, 2013. The squadron achieved an "on track" rating from the team of experts who examined and graded more than 40 programs within VMFA (AW) 224 and trained Marines on areas needing improvement.

Approved by: **February 2016**

Anita U. Hattiangadi – Research Team Leader
Marine Corps Manpower Team
Resource Analysis Division

Abstract

This report is in support of the Marine Corps Force Innovation Office, which is charged with implementing the Marine Corps Force Integration Plan to integrate ground combat occupations and units. We examine female representation and performance in aviation (60XX–75XX) and logistics (04XX) primary military occupational specialties (PMOSs) since FY 1987. Female representation, as a percentage, has increased in these occfields over the past three decades, but women tend to leave the Marine Corps at higher rates than men. We also find, however, that female officers are selected for promotion at the same rates as male officers and that enlisted women are promoted faster than enlisted men. Our findings suggest that women who entered previously closed PMOSs have performed comparably to men and that separation rates differ by occupation suggesting the need to factor in PMOS-specific trends into manpower plans and to learn more about factors motivating separation decisions.

This page intentionally left blank.

Executive Summary

In 2013, the Secretary of Defense rescinded the 1994 Direct Ground Combat Definition and Assignment Rule, opening ground-combat-related military service opportunities to women [1]. In response, the Marine Corps created the Marine Corps Force Innovation Office (MCFIO) to gather research on gender integration and implement the Marine Corps' integration plan. This report is one part of CNA's efforts for MCFIO. This report analyzes the Marine Corps' experience with integration between FY 1987 and FY 2014 to inform expectations about whether and how to integrate combat occupations. We examine gender trends in recruit requirements, retention, and promotions in these occupational communities to highlight factors the Marine Corps should focus on when determining whether and how to open ground combat occupations to women.

In this report, we examine trends in female representation as well as performance differences between men and women for FY 1987 through FY 2014 using Marine Corps personnel data. Our analysis focuses on Marines who held primary military occupational specialties (PMOSs) in any of the aviation occupational fields (occfields) (60XX through 75XX) or the logistics occfield (04XX). We focus on the aviation occupations because (1) the Marine Corps opened the pilot/naval flight officer (NFO) occfield (75XX) to female officers in 1993 and (2) women have been underrepresented in these occupations relative to their overall representation in the Marine Corps. In comparison, the majority of logistics (04XX) occfield PMOSs have been open to female Marines since the 1970s, and women have been relatively overrepresented in this occfield.

Our findings about Marine officers in the aviation and logistics occfields are as follows:

- Female officers are less likely than male officers to have flight aptitude ratings (FARs) that qualify them for the pilot/NFO pipeline.
- Female pilot/NFO students complete flight training at lower rates than male pilot/NFO students. For both men and women, NFO students, those with FARs above the minimum requirement, and those who were not in the bottom third of their classes at The Basic School were the most likely to complete flight training.

- O3-O5 selection rates are similar for men and women within an occupational group (ground logistics, non-pilot/non-NFO aviation, and pilot/NFO), which suggests that male and female officers are equally qualified for these ranks.

- Female officers are less likely than male officers to reach 10 years of commissioned service. The retention gender gap is larger in the aviation occfields than in the ground logistics occfields, which suggests that retention varies across occupations as well as gender.

Our findings about enlisted Marines in the aviation and logistics occfields are as follows:

- In general, female enlisted Marines have lower scores than male enlisted Marines on the technical sections of the Armed Services Vocational Aptitude Battery. This implies that a lower percentage of female recruits, relative to male recruits, will be eligible for technical occupations, such as aviation PMOSs.

- E4-E6 promotion probabilities are similar for men and women within an occfield, but women are more likely than men to be fast promoters (being in the top third of promoters ranked by number of months to promotion). These findings indicate that enlisted women in ground logistics and aviation occupations are just as qualified as enlisted men, if not more qualified.

- Enlisted women have higher first-term attrition rates than men. The first-term attrition rate gender gap is larger in the ground logistics occfields than in the aviation occfields. Beyond the first term, enlisted women have lower attrition rates than men.

Recruits' propensity to serve in an occupation has a direct effect on female representation, and the speed at which newly opened PMOSs are integrated will depend on the Marine Corps' ability to recruit women into them. This report is not able to address these topics, but we recommend that they be part of the Marine Corps' long-term integration analysis plan. When considering and planning for the opening of occupations to women, Marine Corps manpower plans should incorporate differences in men's and women's abilities to meet occupation qualifications and in their continuation rates. The Marine Corps could use current open PMOSs that require similar skills as the PMOSs being considered for integration to estimate these effects. Understanding these effects is important for maintaining viable career paths and avoiding the creation of gaps in leadership. To better understand gender differences in retention rates, the Marine Corps' longer-term analysis plan should include analysis of why Marines transition from the Marines Corps. The systematic collection of data through exit surveys or interviews will give the Marine Corps insights into the factors that affect men's and women's retention decisions and will determine whether it should implement mitigating practices or policies.

Contents

List of Figures

List of Tables

Glossary

AC	Active Component
ADSD	Active Duty Service Date
AQR	Academic Qualification Rating
ARMS	Automated Recruit Management System
ASTB	Aviation Selection Test Battery
ASVAB	Armed Services Vocational Aptitude Battery
Capt	Captain
CCLEB	Commandant's Career-Level Education Board
CPIB	Commandant's Professional Intermediate-Level Board
DEP	Delayed Entry Program
EAS	End of Active Service
EL	Electronics
FAR	Flight Aptitude Rating
FY	Fiscal Year
GCT	General Classification Test
GT	General Technical
LtCol	Lieutenant Colonel
Maint.	Maintenance
Maj	Major
MARADMIN	Marine Corps Administrative Message
MCFIO	Marine Corps Force Innovation Office
MCFIP	Marine Corps Force Integration Plan
MCRISS	Marine Corps Recruiting Information Support System
MCTFS	Marine Corps Total Force System
ME	Marginal Effect
METOC	Meteorology and Oceanography
MM	Mechanical Maintenance
MOS	Military Occupational Specialty

NAMI	Naval Aerospace Medical Institute
NFO	Naval Flight Officer
No.	Number
NROTC	Naval Reserve Officer Training Corps
OCC	Officer Candidate Course
Occfield	Occupational Field
OCS	Officer Candidates School
Pct.	Percentage
PEF	Program Enlisted For
PFT	Physical Fitness Test
PLC	Platoon Leaders Class
PMOS	Primary Military Occupational Specialty
TBS	The Basic School
USNA	United States Naval Academy
YCS	Years of Commissioned Service

Introduction

Over the past several years, Congress and the Department of Defense have asked the services to investigate their ability to expand opportunities for women in the military. In January 2013, the Secretary of Defense rescinded the 1994 Direct Ground Combat Definition and Assignment Rule, shifting the burden of justifying whether a primary military occupational specialty (PMOS) should remain closed to women to the individual service chiefs [1]. In May 2013, the Secretary of Defense received the Marine Corps' integration plan, addressing two integration efforts: the opening of ground combat PMOSs to women and the assignment of women in open PMOSs to previously closed ground combat units [2].[1] The Marine Corps has until January 1, 2016, to integrate ground combat positions or to ask for exceptions to policy.

In response to the repeal of the restriction on women in ground combat roles, the Marine Corps stood up the Marine Corps Force Innovation Office (MCFIO) to implement its integration plan.[2] The Director of MCFIO has asked CNA to provide analytical support on several issues pertaining to both the opening of PMOSs closed to women and the assignment of women in open PMOSs to previously closed units. This report is one part of CNA's greater effort for MCFIO, and it pertains to the issue of opening closed PMOSs to women. Our goal in this study is to quantitatively analyze the Marine Corps' past experiences with gender integration to provide (1) insights into some of the factors the Marine Corps should consider when determining how to open ground combat PMOSs to women and (2) examples of metrics it may consider for tracking the success of this integration.

[1] The Marine Corps subsequently developed the Marine Corps Force Integration Plan (MCFIP), which consists of four lines of effort to assist the Commandant of the Marine Corps with his decision about asking for exceptions to policy [3]. MCFIP includes the following four levels of effort: (1) the opening of some ground combat units to women in open PMOSs, (2) continuing research efforts about the integration of ground combat entry-level PMOS training, (3) the creation of a ground combat element integrated task force, consisting of male and female Marine volunteers, to test whether an integrated combat unit can perform unit-level, collaborative tasks as well as closed units, and (4) the opening of nine previously closed PMOSs in September 2014 (see [4]).

[2] The integration plan includes the development of a longitudinal analysis plan to track ground combat integration efforts.

The Marine Corps and gender integration

The topic of women's roles in military service has been debated several times throughout history, and their roles have expanded over time [5-7].[3] In most cases, these decisions came on the heels of military conflicts when manpower constraints pushed the services and Congress to examine expanding the role of women. For example, after World War II, the Women's Armed Services Act in 1948 allowed women for the first time to serve full-time in the services' active components in limited roles, such as in the administrative and supply occupations, during peacetime [5]. During the Korean War (June 1950 to July 1953), the Marine Corps expanded the number of occupational fields (occfields) in which female officers and enlisted women could serve, although they could not serve in the majority of aviation (including pilot occupations) and ground combat occupations [6].

In the late 1960s and early 1970s, the pressures of the civil rights movement and the notions of equal opportunity and affirmative action caused the Secretary of Defense to direct the services to develop plans that provided equal opportunity for minority and female servicemembers [6-7]. In response, the Marine Corps formed an equal opportunity committee, headed by Colonel Albert Snell, in 1972 to recommend how the Corps could promote equal opportunity among Marines. The committee's recommendations included changes to promotion procedures and the policies barring women from occupations and service schools. Soon after the committee released its recommendations, the Marine Corps opened logistics occupations to female officers. In 1975, the Commandant, General Wilson, revoked the exclusion of women in all occupations except those that were combat related: infantry, artillery, tank, and pilot/NFO.

Social, economic, and political transformations in American society, and the performance of the thousands of women who deployed during the Persian Gulf War (August 1990 to January 1991) led to the further expansion of women's service roles [7]. In 1993, the Marine Corps lifted the restriction on women serving in combat aviation occupations, including pilots, NFOs, and landing support personnel. This opened all Marine occupations to women except those for which the 1994 Direct Ground Combat Definition and Assignment Rule applied.

[3] See Devilbiss [5], Stremlow [6], and Rosenau and McAdam [7] for more details about the history of women in military service. Devilbiss [5] discusses gender integration issues across all of the military services; Stremlow [6] and Rosenau and McAdam [7] focus on the Marine Corps.

The topic of women serving in ground combat occupations resurfaced in the FY 2013 National Defense Authorization Act, in which Congress requested a report on the feasibility of developing gender-neutral standards for military occupations currently closed to women [8]. In April 2012, the Marine Corps announced that it would begin to assign women in open PMOSs to some ground combat units [9]. With the repeal of the direct ground combat rule, the Marine Corps began looking at opening occupations closed to women, and at the start of FY 2015, it opened nine ground combat PMOSs [4].[4]

Study issues

This study's goal is to provide the Marine Corps with quantitative data to support its decisions regarding the integration of ground combat occupations.[5] Some of the Marine Corps' concerns include the following: How will gender integration in the ground combat occupations affect force readiness? How will men and women respond to the opening of ground combat occupations? How will women perform in these occupations relative to men?

Unfortunately, we cannot directly address these questions because women have not served in these occupations. Instead, we use historical manpower data to analyze occupations with different levels of female representation to identify factors that contribute to these differences so that the Marine Corps can incorporate these factors into its integration plans.

Data

For our analysis, we use Marine Corps manpower data from FY 1987 through FY 2014 from the Automated Recruit Management System (ARMS), the Marine Corps Recruiting Information Support System (MCRISS), the Marine Corps Total Force System (MCTFS), and Total Force Data Warehouse (TFDW) to track Marines' careers

[4] The Marine Corps opened the following PMOSs: 0803 (targeting effects officer), 0842 (field artillery field operator), 0847 (artillery meteorological man), 2110 (ordnance vehicle maintenance officer), 2131 (towed artillery systems technician), 2141 (assault amphibious vehicle repairer/technician), 2146 (main battle tank repairer/technician), 2147 (light armored vehicle repairer/technician), 2149 (ordnance vehicle maintenance chief), 7204 (low altitude air defense officer), and 7212 (low altitude air defense gunner).

[5] This study does not directly address the issue of assigning women to ground combat units.

from AC entry through separation.[6] To reduce the amount of data we present, we limit our analysis to Marine officers and enlisted Marines who held a logistics (04XX) or aviation (60XX-75XX) PMOS.[7] Table 1 lists the occfields of interest and the types (officer or enlisted) of PMOSs used in this report.[8]

Table 1. Marine Corps logistics and aviation occfields, Aug. 2013[a]

Occfield number and name	Occfield includes officer/enlisted PMOSs[a]
Ground logistics occfields	
04, Logistics[b]	Officer/enlisted*
Aviation occfields	
60, Aircraft Maintenance	Officer/enlisted*
61, Aircraft Maintenance (rotary-wing)	Enlisted
62, Aircraft Maintenance (fixed-wing)	Enlisted
63, Organizational Avionics Maintenance	Enlisted*
64, Intermediate Avionics Maintenance	Enlisted
65, Aviation Ordnance	Enlisted*
66, Aviation Logistics	Officer/enlisted*
68, Meteorology and Oceanography (METOC)	Enlisted*
70, Airfield Services	Enlisted*
72, Air Control/Air Support/Antiair Warfare/Air Traffic Control[c]	Officer/enlisted
73, Navigation Officer/Enlisted Flight Crew	Enlisted*
75, Pilot/Naval Flight Officer	Officer

Source: Marine Corps MOS Manual [10].

a. Officer PMOSs include those suitable for regular unrestricted officers or career reserve officers. Asterisks indicate that occfields also include limited duty officer or warrant officer PMOSs; these PMOSs are not the focus of this study and are excluded from the analysis.

b. Women were first assigned to the 0481, landing support, PMOS in FY 1995.

c. We exclude from analysis the PMOSs in two occfields that were closed to women before FY 2015: 7204, low altitude defense officer, and 7212, low altitude air defense gunner.

[6] The ARMS contains recruit information from 1990 through 2002. MCRISS contains recruit information from 2003 to the present.

[7] Although not reported, we also performed analysis on Marines in the supply administration and operations (30XX) and motor transport (35XX), and these results are available by request.

[8] For our analysis, we exclude limited duty officers and warrant officers PMOSs. In addition, we exclude the PMOSs in these occfields that were closed to women before FY 2015: 7204, low altitude defense officer and 7212, low altitude air defense gunner. The Marine Corps opened these occupations to women at the start of FY 2015 [4].

We focus on the aviation occupations because (1) the pilot/naval flight officer (NFO) (75XX) occfield was opened to female officers in 1993, so we can analyze how male and female officers have performed in these occupations since integration, and (2) female representation in these occupations has been below or equal to that of the Marine Corps overall. In comparison, with the exception of the 0481 PMOS (landing support), which was integrated in FY 1995, female officers and enlisted Marines have served in the logistics throughout our period of analysis (FY 1987 to FY 2014) and have been relatively overrepresented in this community. Therefore, we can compare how men and women perform in occupations with relatively low (aviation) and relatively high (logistics) female representation.

Approach

Female representation in an occupation is a function of the rate at which women enter and leave a community; therefore, we first examine trends regarding who qualifies for these occupations, followed by an examination of who stays in these occupations. Specifically, we analyze the following questions for officers and enlisted Marines in logistics and aviation PMOSs:

- What is the relationship between PMOS qualifications and female representation? Are women more or less likely to meet recruit qualifications for these occupations?
- How do women perform relative to men in logistics and aviation occupations? What factors explain male and female flight training completion rates? Are men and women in these occupations promoted at similar rates? Are there differences in male and female retention rates, and what factors explain retention trends?

In addition to within-occupational gender differences, we also examine what has happened to these differences over time and make comparisons across occupational communities. When appropriate, we also perform regression analysis to isolate characteristic-specific (e.g., gender) effects on performance outcomes.

Organization

The rest of this report contains six sections. In section 1, we shows how female representation in the ground logistics and aviation occfields has changed over time providing a foundation for the analysis that follows. In section 2, we analyze the relationship between gender and PMOS requirements, followed by an analysis of flight training completion rates in section 3. In sections 4 and 5, we examine the performance of officers and enlisted Marines, respectively, in logistics and aviation

PMOSs. The sixth section outlines the implications of our analysis for the future opening of ground combat occupations and units to women.

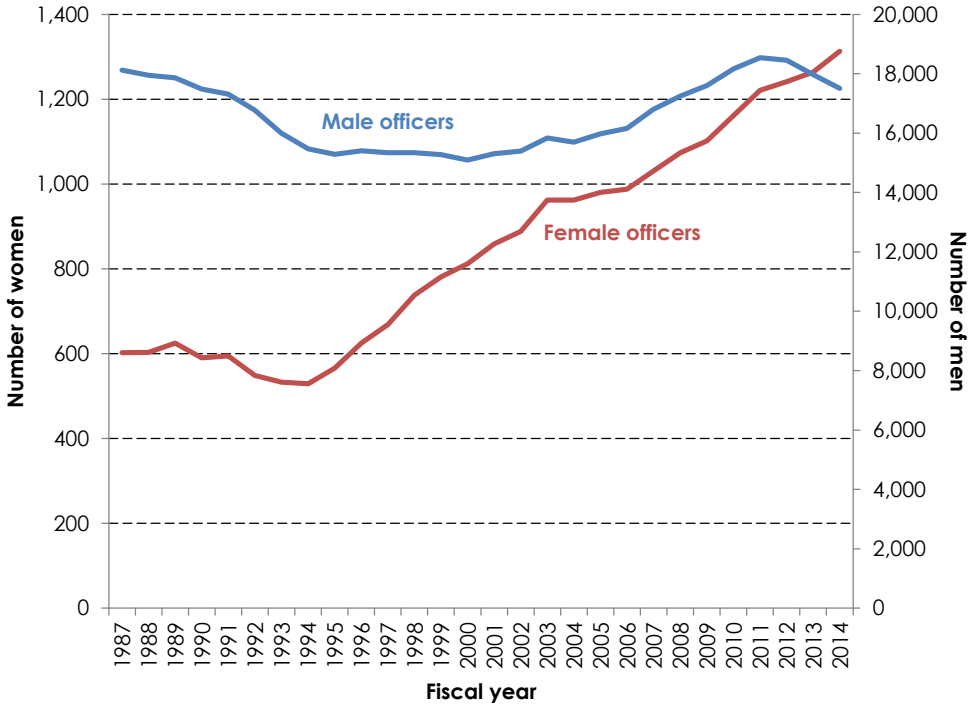
Female Representation

In this section, we present an examination of trends in female representation among the Marine Corps' officer and enlisted forces as background for understanding the gender mix in the aviation and logistics occfields.

Female representation in the officer corps

Figure 1 shows officer endstrength, by gender, at the end of each fiscal year from FY 1987 to FY 2014.

Figure 1. Number of Marine officers by gender, FY 1987 to FY 2014



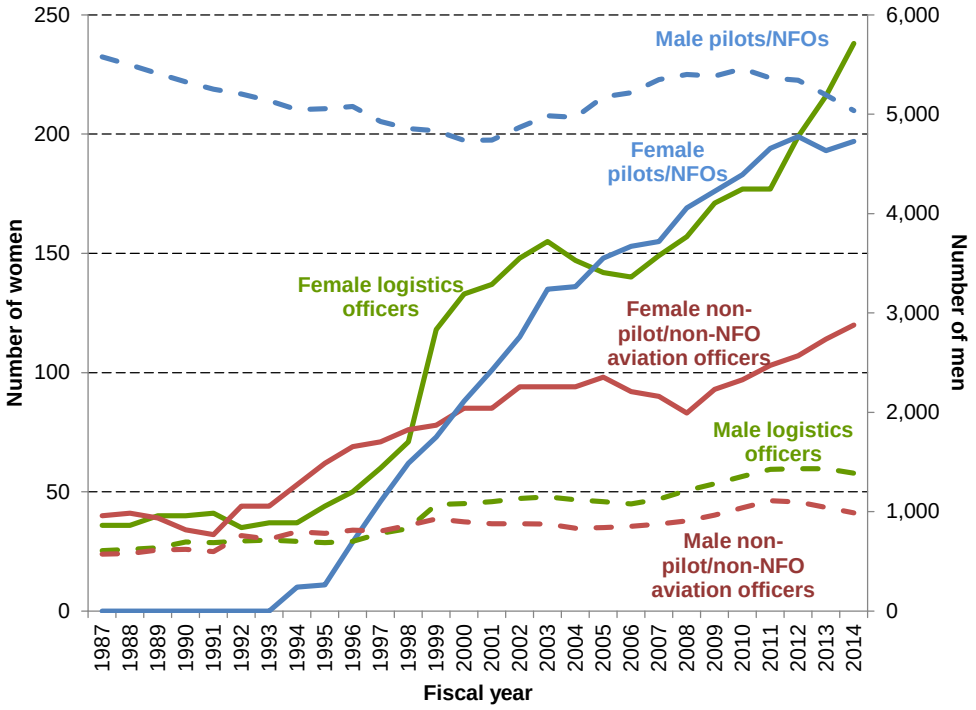
Source: CNA tabulations from TFDW September snapshot data. Data include officers with intended PMOSs (XX01), student pilots (7599), and NFO student (7578 and 7580).

The data in Figure 1 show that men predominately make up the officer corps, and the changes we observe in the number of men mirror the patterns for the officer corps as a whole. For example, we observe the effect of the endstrength drawdown in the early 1990s, the endstrength buildup from FY 2007 to FY 2010, as well as the most recent drawdown, which began in FY 2011, in the number of male officers.

The number of female officers in the Marine Corps does not appear to follow overall officer endstrength trends. We see a slight drop during the drawdown of the early 1990s, but that number has grown since 1994. Between FY 1994 and FY 2014, the number of female officers rose from 529 to 1,313—a 148-percent increase. Except for a short period of little to no growth (FY 2003 to FY 2006), the number of female officers has steadily increased by an average of 40 women per fiscal year since 1994.

The growth in the number of female officers that we observe is not distributed equally across occupational groups. Figure 2 shows the number of officers, by gender, in the logistics (04XX) and aviation (60XX-75XX) occfields. Because the Marine Corps opened the pilot/NFO (75XX) occfield to female officers in 1993, we separate this occfield from other non-pilot/non-NFO aviation occfields (60XX-72XX).

Figure 2. Number of Marine officers by gender and occupation, FY 1987 to FY 2014

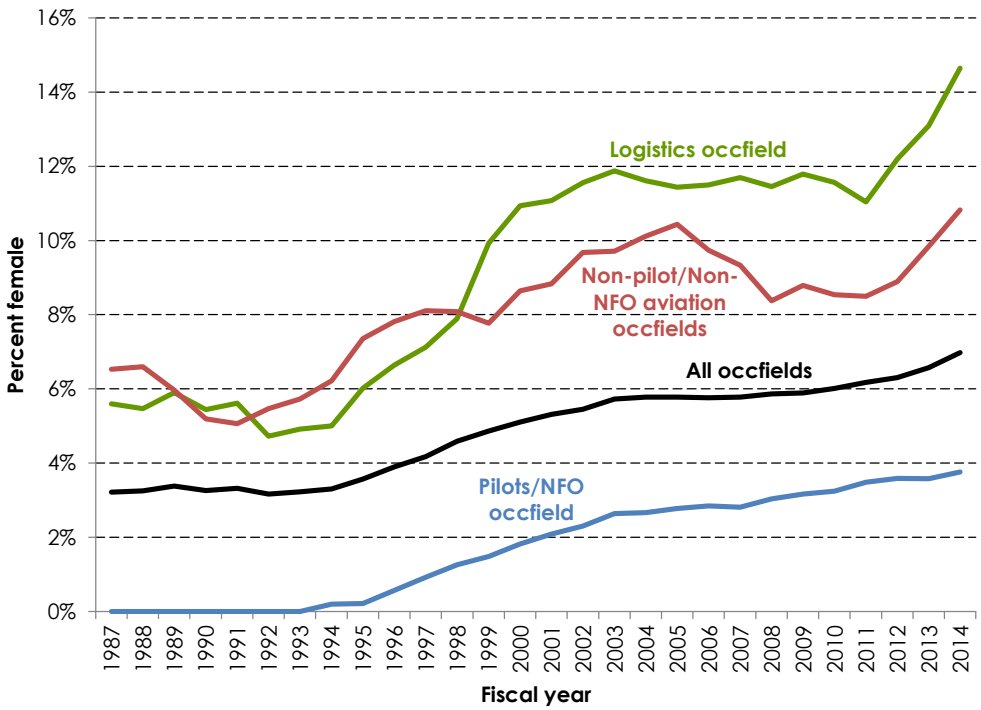


Source: CNA tabulations from TFDW September snapshot data. Data include officers with intended PMOSs (XX01), student pilots (7599), and NFO student (7578 and 7580).

The data show that the growth in the number of female officers was largest for the pilot/NFO occfield (increasing by almost a factor of 20 from when the occfield was integrated, in FY 1994, to FY 2014), followed by non-pilot/non-NFO occfields and the logistics occfield—each roughly tripling between FY 1987 and FY 2014.

Figure 3 shows that, as a percentage, female representation increased in these occfields during this period as well. Overall, female representation in the officer corps grew from 3 percent in FY 1987 to almost 7 percent in FY 2014. Comparing the logistics and aviation occfields, we find that female representation grew the most in logistics occfields (from 5.6 percent in FY 1987 to 14.6 percent in FY 2014), followed by non-pilot/non-NFO occfields (6.6 to 10.8 percent) and the pilot/NFO occfield (0 to 3.8 percent). In general, female officers are overrepresented (relative to the whole officer corps) in the logistics and non-pilot/non-aviation occfields and under-represented in the pilot/NFO occfield.

Figure 3. Percentage of officers who were women, by occupation, FY 1987 to FY 2014



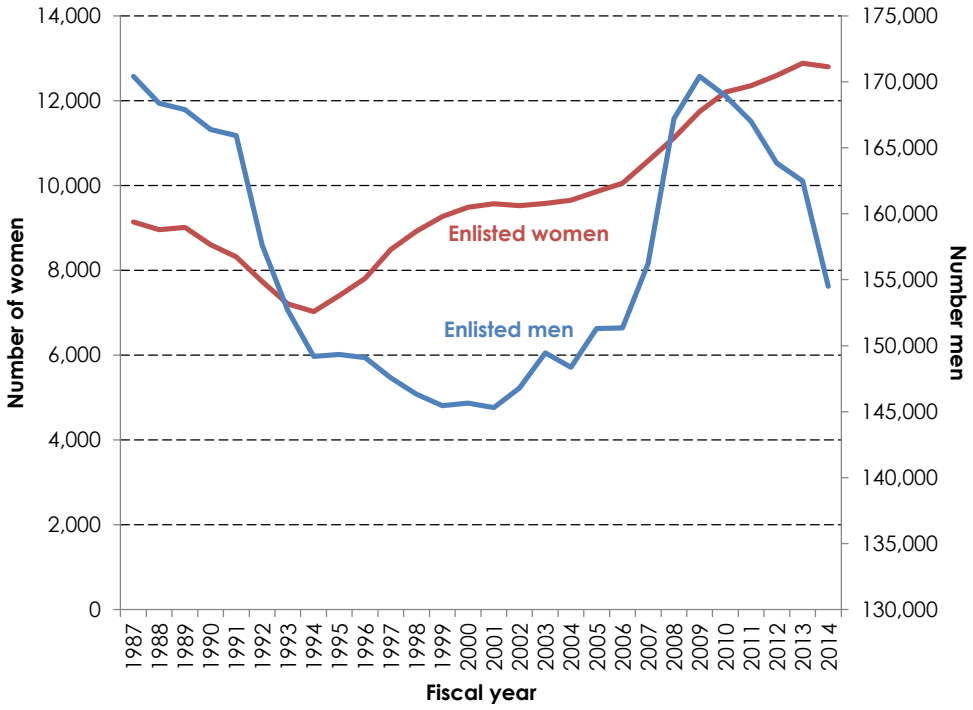
Source: CNA tabulations from TFDW September snapshot data. Data include officers with intended PMOSs (XX01), student pilots (7599), and NFO student (7578 and 7580).

Because the pilot/NFO occfield was integrated during our analysis period, it bears further analysis as a possible benchmark from which the Marine Corps may build expectations about the opening of ground combat occupations. Note the continued growth in the percentage of officers who were women. Even 20 years after integration, the Marine Corps has yet to reach a steady state in female representation (in the pilot/NFO occfield as well as overall), but the growth has slowed. For example, from FY 1997 to FY 2003, the year-to-year growth rate in the number of female pilots/NFOs ranged between 14 and 59 percent; from FY 2004 to FY 2014, the growth ranged between -3 and 9 percent. The Marine Corps may experience a similar pattern in the ground combat occupations if it decides to open to women.

Female representation in the enlisted force

Figure 4 shows enlisted endstrength, by gender, from FY 1987 to FY 2014. Similar to officers, trends in the number of enlisted men and women differ from each other.

Figure 4. Number of enlisted Marines by gender, FY 1987 to FY 2014

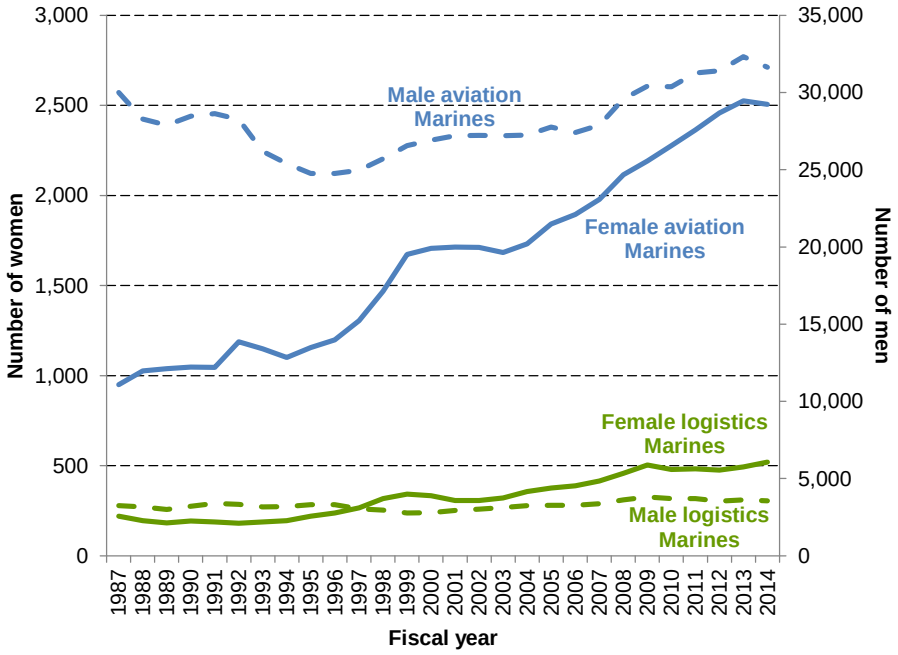


Source: CNA tabulations from TFDW September snapshot data. Data include Marines with intended PMOSs (XX00).

In Figure 4, changes in the number of enlisted men reflect changes to the Marine Corps' AC endstrength, declining with the endstrength drawdown in the 1990s, growing with the endstrength buildup between 2007 and 2010, and declining with the current drawdown. The number of enlisted women follows a trend similar to that of the number of female officers: the number fell during the drawdown of the 1990s but has grown since, from roughly 7,000 in FY 1994 to 12,800 in FY 2014.

Figure 5 shows the number of male and female enlisted Marines in the logistics and aviation occfields.[9] The data show different trends for the numbers of enlisted men and enlisted women in each of these occupational groups. In the aviation occfields, the number of enlisted men decreased in the mid- to late-1990s, while the number of enlisted women increased. From FY 1995 through FY 2014, the number of enlisted men and women grew, but at different rates: the number of women rose from 1,155 to 2,506 (a 117-percent increase), while the number of men rose from 24,749 to 31,632 (a 28-percent increase).

Figure 5. Number of enlisted Marine by gender and occupation, FY 1987 to FY 2014



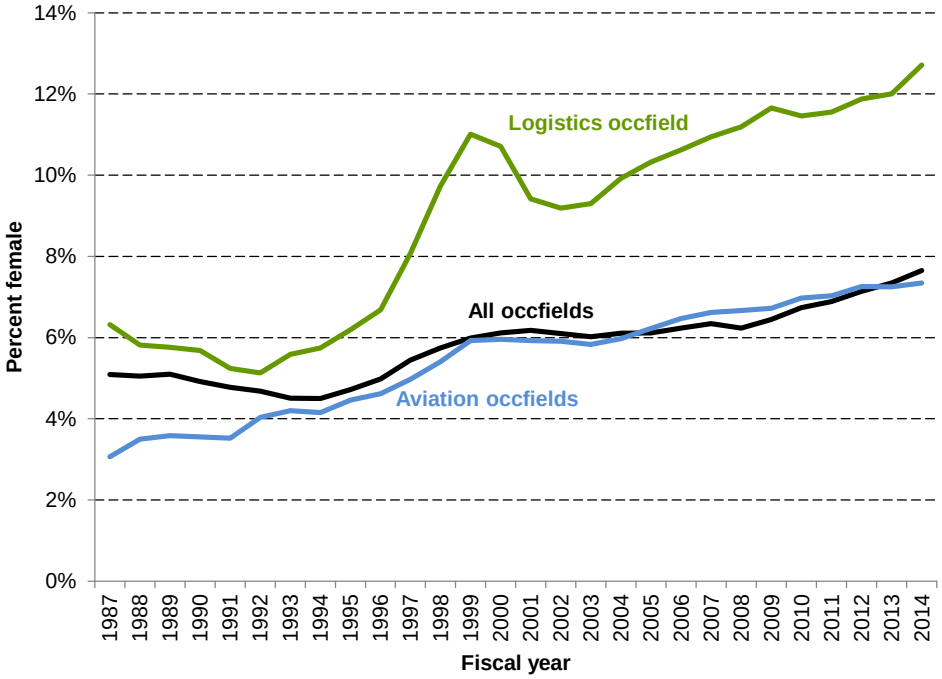
Source: CNA tabulations from TFDW September snapshot data. Data include Marines with intended PMOSs (XX00).

[9] See Appendix A for the occfield-specific counts.

In the logistics occfield, the number of men ranged between 3,200 and 3,300 in the late 1980s and early 1990s, before dropping to 2,773 in FY 1999. During the late 1990s, the number of women grew from 194 in FY 1994 to 343 in FY 1999; in FY 2000 and FY 2001, the number of women in logistics fell to just over 300 before it began increasing again. Between FY 2001 and FY 2009, the numbers of both women and men in logistics occupations grew—by 64 percent for women (from 306 to 503) and by 30 percent for men (from 2,944 to 3,813). During the most recent endstrength drawdown, the number of men and women fell slightly, although the number of women increased in FY 2013 and FY 2014.

As Figure 5 shows, the number of enlisted Marines in aviation and logistics occfields is very different. To understand how the composition of the logistics and aviation communities has changed as the numbers of men and women have changed, Figure 6 shows the percentage of enlisted Marines, by occupational group, who were women.

Figure 6. Percentage of enlisted Marines who were women, by occupation, FY 1987 to FY 2014



Source: CNA tabulations from TFDW September snapshot data. Data include Marines with intended PMOSs (XX00).

Overall, the percentage of the enlisted force who were women has grown between FY 1987 and FY 2014, going from 5.1 percent to 7.7 percent. Relative to the enlisted

force overall, women are overrepresented in the logistics enlisted force, and their representation in the logistics enlisted force has grown over time—from 6.3 percent in FY 1987 to 12.7 percent in FY 2014. In the aviation occfields, female representation in the enlisted force also increased: Women were relatively underrepresented in aviation occupations between FY 1987 and FY 2005, overrepresented between FY 2005 and FY 2013, and underrepresented in FY 2014. Between FY 1987 and FY 2014, the percentage of women in enlisted aviation occupations rose from 3.1 percent to 7.3 percent.

Summary

Our examination of female representation indicates that female representation has grown in the Marine Corps overall as well as in the logistics and aviation occfields. When we look at the percentage of Marines who were female, we find that the logistics occfield has above-average female representation for both officers and enlisted Marines. In the aviation officer communities, women are underrepresented in the pilot/NFO occfield, overrepresented in other non-pilot/non-NFO aviation occfields. In the aviation enlisted communities, female representation is similar to that of the enlisted force overall.

Since the pilot/NFO occfield experienced integration during our period of analysis, the Marine Corps may be able to use the findings for this occfield to build expectations about changes in female representation in the ground combat occupations it decides to integrate in the future. The data suggest that female representation will experience a period of rapid growth right after integration, but the growth rate will fall after a period. The Marine Corps will need to keep this in mind when building its recruiting and manpower plans for the ground combat occupations it integrates in the future.

Female representation in an occfield is a function of the fraction of new recruits entering the occfield who are women and the male and female retention rates. If male and female retention rates are the same but women make up a small (large) percentage of new recruits, then female representation in the occfield will be low (higher). Or, if the new recruits are split equal across the gender but men have higher (lower) retention rates than women, then female representation will be low (high). In the next two sections, we investigate these factors that drive female representation in an occupation. These factors are important because they have implication for manpower planning, such as how many to promote and ensuring that the paygrade structure is sufficiently manned at all levels with quality Marines.

In the next section, we examine the relationship between gender and PMOS requirements, which determine which recruits enter the logistics and aviation occfields.

Gender and PMOS Requirements

Female representation in an occfield will depend on the Marine Corps' ability to recruit women into those occupations. This will depend on women's inclination to join the Marine Corps to serve in these occupations as well as their qualifications and skills. We do not have data on potential female recruits' inclinations for logistics and aviation occupations; however, we can examine the relationship between gender and PMOS requirements. If women are more (or less) likely to meet the requirements for a specific PMOS, we might expect to observe higher (lower) female representation in that PMOS.

Selection for pilot and NFO contracts

Officer assignments are based on the needs of the Marine Corps, individual officer candidates' skills and qualifications, and officer occupation preferences. Most officers receive their assignments at the end of The Basic School (TBS).[10] To distribute officer quality across occupations, the Marine Corps ranks TBS graduates from a class and divides them into thirds, assigning one-third of placements for an occupation from the top third of a class, one-third from the middle third, and one-third from the bottom third.[11]

Pilot and NFO assignments do not follow this assignment path; flying contracts are given prior to TBS at officer selection. Officer candidates interested in serving as pilots and NFOs must pass the Aviation Selection Test Battery (ASTB) and the Naval Aerospace Medical Institute (NAMI) physical.[12] Officer candidates need a flight aptitude rating (FAR) of 6 or better (on a scale from 1 to 9) on the ASTB to qualify for a flying contract.

[10] Recruits are designated as aviation, legal, or ground at commission, prior to TBS. See Hosek et al. [11] for more details on officer career paths for the military services and the differences between men and women.

[11] Appendix B shows data on the percentage of male and female officer candidates who enter the logistics (04XX) and aviation (60XX-75XX) occfields.

[12] Officer candidates who wish to be aviators or NFOs need to meet anthropometric measurement restrictions to ensure that their builds are suited to flying a specific platform.

U.S. Naval Academy (USNA) midshipmen are administered the ASTB and NAMI physical while at the USNA, and a USNA Service Assignment Review Board uses these results along with other performance metrics to determine midshipmen's service assignments [12].[13] Officer candidates taking the Platoon Leaders Class (PLC) take the ASTB and NAMI physical before they go before the Officer Candidates School (OCS) selection board, whereas candidates taking the Officer Candidate Course (OCC) take the ASTB before the selection board and the NAMI after they have been selected for OCS [13].

ASTB performance has been shown to be positively correlated with flight training performance [14-15]. Baisden [14] studied over 13,000 men and 400 women who entered naval aviation training between 1984 and 1991. She found statistically significant gender differences in selection screening. Specifically, she found that men had higher FARs than women but that women had higher academic qualification ratings (AQRs), which are determined by the ASTB. Another study by a Naval Postgraduate School student [15] found that FARs were positively correlated with grades during the flight portion of primary flight training. In this subsection, we examine FARs for Marine flight and NFO students. We also examine the percentage of USNA Marine officers who received aviation service assignments.

The ARMS and MCRISS data include PLC and OCC officer candidates' FARs as well as USNA service assignments.[14] We examine these data to determine if men and women qualify for pilot/NFO assignments at different rates.

Male and female PLC and OCC officer FARs

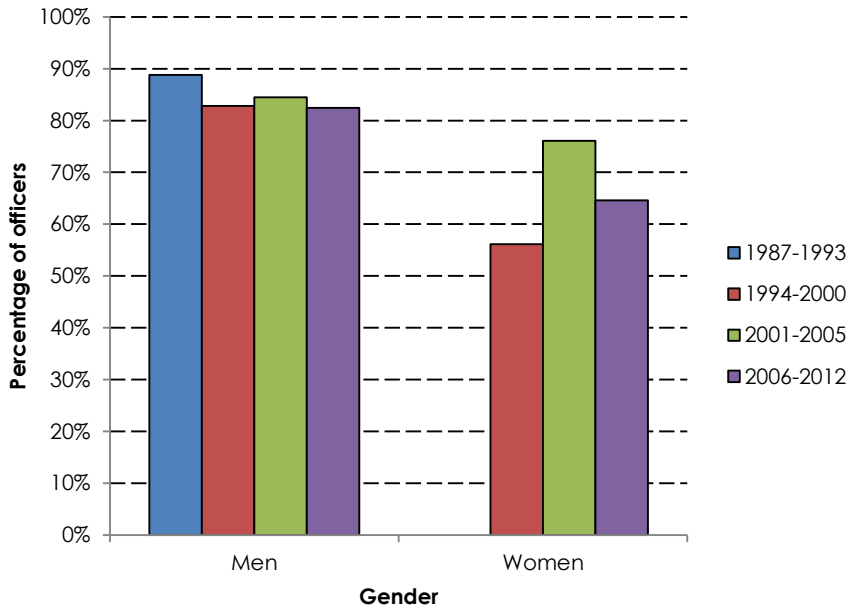
Of the OCC and PLC officer candidates for whom we observe FARs, we find that men generally have higher FARs than women. Since FY 1994, male FARs are 1 point higher than female FARs (6.1 versus 5.2), on average, and 83 percent of men and 65 percent of women had FARs of 6 or better. In Figure 7, we show the percentage of OCC and PLC officer candidates with FARs of 6 or better by gender and commission FY. Over

[13] USNA service assignments do not specify a particular PMOS but rather a broad community, such as medical, nuclear submarine, Navy pilot, special warfare, surface warfare officer, Marine Corps ground, Marine Corps pilot, or Marine Corps NFO. For our analysis, we group Navy pilot, Marine Corps pilot, and Marine Corps NFO together.

[14] We observe FARs in the Marine Corps manpower data for 50 percent of the officers whose first PMOS was in the pilot/NFO occfield. We do not observe many FARs for aviation officers who went to the USNA or Naval Reserve Officer Training Corps (NROTC), but we do observe a large number of FARs for those who completed OCC and PLC. If we restrict the population to aviation officers who completed OCC and PLC, we have FARs for 74 percent of men and 68 percent of women whose first PMOS was in the pilot/NFO occfield.

the past 20 years, the percentage of male officer candidates who took the ASTB and earned a FAR of 6 or better has fallen from 89 percent (FY 1987 to FY 1993 commission cohorts) to 82 percent (FY 2006 to FY 2010 commission cohorts). The percentage of female officer candidates who earned a 6 or better FAR has fluctuated over time, but we find that female officers from the FY 2006-FY 2010 commission cohorts were more likely to have FARs of 6 or better than female officer candidates from the FY 1994-FY 2000 cohorts—65 percent compared with 56 percent. These findings suggest that fewer women qualify to be pilots, which partially explains why women make up a relatively lower percentage of pilots and NFOs.

Figure 7. Percentage of OCC and PLC officer candidates with FARs of 6 or better, by gender and commission FY



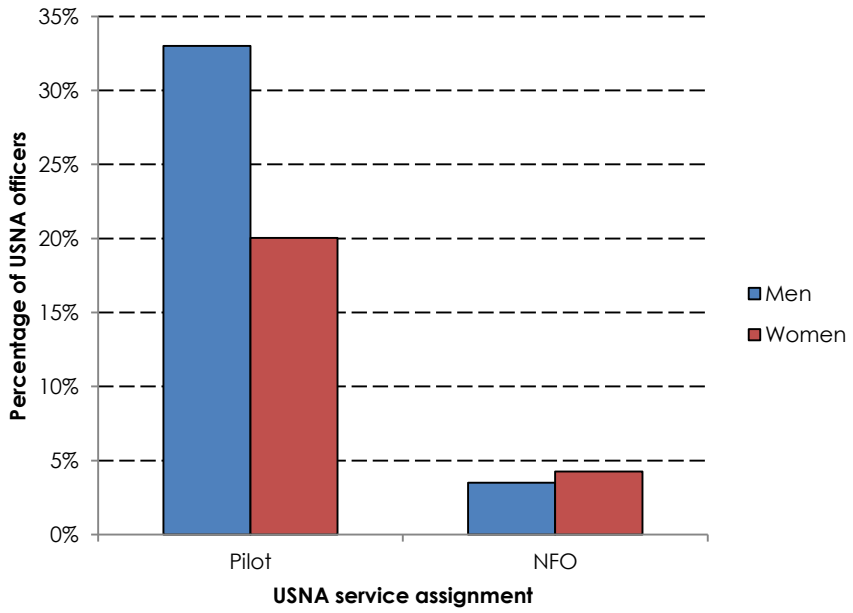
Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Sep. 2012.

USNA Marine pilot/NFO service assignments

Because we do not observe ASTB data for USNA Marine officers, we analyzed USNA service assignments for USNA officers commissioned between FY 1994 and FY 2012. This population includes over 3,000 male officers and almost 470 female officers. In Figure 8, we show the percentage of USNA officers who received a pilot or NFO assignment, by gender. We find that male officers were more likely than female officers to receive a pilot assignment but that men are slightly less likely than women

to receive an NFO assignment. Specifically, we find that 33 percent of male USNA officers and 20 percent of female USNA officers received pilot USNA service assignments, while 3.5 percent of the men and 4 percent of the women received NFO assignments. If we assume that the FAR findings for PLC and OCC officer candidates extend to the USNA community, one reason women may be less likely to receive a pilot service assignment is that fewer of them earn a FAR of 6 or better.

Figure 8. Percentage of USNA officers who received a pilot or NFO assignment, commission FY 1994 to FY 2012



Source: CNA tabulations of MCRISS and MCTFS snapshot data from Oct. 1993 through Sep. 2012.

Trends in enlisted ASVAB scores

When recruited, qualified recruits are assigned a Program Enlisted For (PEF). A PEF contains all of the PMOSs for which a recruit qualifies and for which the recruit has agreed to train. The Marine Corps classifies a recruit to one of the PMOSs in the PEF during bootcamp and sends the Marine to the PMOS schoolhouse to receive training.

Marine Corps Recruiting Command provided us with a list of the FY 2015 PEFs. In addition to the PMOSs that make up the PEF, each PEF contains minimum eligibility requirements. These eligibility requirements include minimum ASVAB section scores

(i.e., general technical (GT), mechanical maintenance (MM), electronics (EL), and clerical (CL)), physical requirements (e.g., minimum/maximum height or vision), and non-waiverable offenses (e.g., traffic violations). Table 2 describes the FY 2014 PEFs for logistics and aviation PMOSs.

We want to know what percentage of enlisted recruits qualified for these PEFs. Our data contain individual ASVAB section scores, so we can see what percentage of male and female enlisted recruits were eligible for aviation and logistics PEFs each FY. We do not have complete data on some of the other requirements (e.g., vision and clearances), so we restrict our analysis to the ASVAB PEF requirements—specifically GT, MM, and EL scores.

In Figure 9 through Figure 11, we show average GT, MM, and EL scores by gender and fiscal year of accession. In general, women tend to have lower GT, MM, and EL scores than men. The male-female gap is largest for MM scores; in FY 2013, the average male MM score was 106.5, and the average female score was 95.0. This gap has been relatively constant since FY 2006. For the other ASVAB scores, the male-female test score gap has widened in recent years. Between FY 2001 and FY 2013, male recruits' average GT scores increased roughly 4 points on average, going from 105 to 109, while female recruits' average GT scores increased by 3 points on average, going from 100 to 103. Male recruits' average MM scores increased by 5 points, going from 104 to 109, while female recruits' average MM scores increased by 3 points, going from 100 to 103.

PEFs with more ASVAB requirements (i.e., requiring both GT and MM scores) or those with higher minimum scores will be the most restrictive, and fewer recruits will qualify for these PEF. Applying the FY 2015 PEF requirements to past accession cohorts, we find that aviation PEFs, compared with the logistics PEF, are more restrictive in terms of required ASVAB scores: 70 to 80 percent of male recruits and 60 to 70 percent of female recruits are eligible for the logistics PEF (see Figure 12 and Figure 13). This is one reason why female representation is higher in logistics occupations than in aviation occupations.

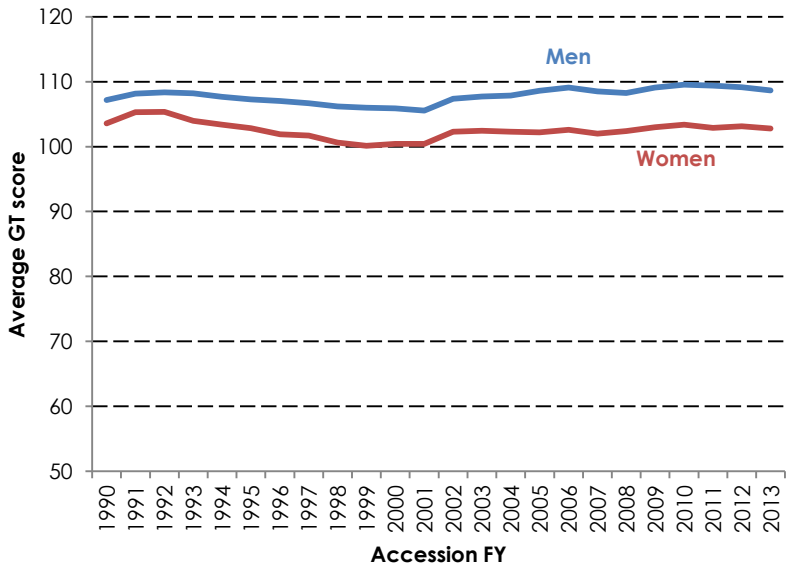
We find that the enlisted aircrew PEF is the most restrictive in that fewer recruits are eligible for this PEF than for any of the non-pilot/non-NFO aviation PEFs or the logistics PEF. Since FY 2000, roughly 40 to 45 percent of male enlisted recruits scored high enough on the ASVAB to qualify for the enlisted aircrew PEF, while less than 20 percent of female recruits scored high enough. At the other extreme, the least restrictive aviation PEF is the aviation electronics technician for female recruits and the aviation support and aviation electronics technician PEFs for male recruits; over the last decade, roughly 40 percent of female recruits and 65 percent of male recruits scored high enough on the ASVAB to qualify for these PEFs. The PMOSs that fall into these less restrictive PEFs also have higher female representation than the PMOSs associated with the more restrictive PEFs.

Table 2. Aviation and logistics PEFs, FY 2014

PEF	Occfields	Requirements
Aviation support	65, Aviation ordnance technician 70, Airfield services	U.S. citizen GT score of 105 or better MM score of 95 or better Eligible for secret clearance Possess a valid civilian driver's license Pass color blindness tests Vision correctable to 20/20 Minimum height 64 inches Maximum height 75 inches No driving offenses other than traffic violations
Aviation mechanic	60, Aircraft maintenance 61, Aircraft maintenance (rotary wing) 62, Aircraft maintenance (fixed wing)	MM score of 105 or better Pass color blindness tests
Enlisted aircrew	61, Aircraft maintenance (rotary wing) 62, Aircraft maintenance (fixed wing)	U.S. citizen GT score of 110 or better MM score of 105 or better Water survival qualification Eligible for secret clearance Pass color blindness tests Vision uncorrectable 20/100 or better in each eye (correctable to 20/20) Normal depth percent Pass flight physical
Aviation Operations	72, Air control/ Air support/ Antiair warfare/ Air traffic control 73, Navigation officer/ enlisted flight crew	U.S. citizen GT score of 105 or better Eligible for secret clearance Pass color blindness tests
Aviation electronics technician	59, Electronics maintenance 63/64, Avionics 66, Aviation logistics	U.S. citizen EL score of 105 or better Eligible for secret clearance Pass color blindness tests Successfully completed one year of high school algebra or higher math
Logistics option	04, Logistics 23, Ammunition and explosive ordnance disposal	U.S. citizen GT score of 100 or better Eligible for secret clearance

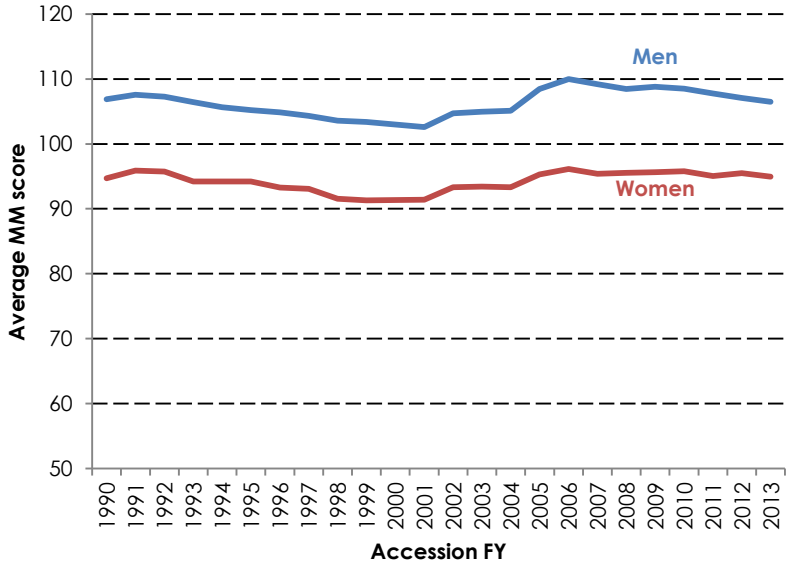
Source: PEF criteria provided by Marine Corps Recruiting Command.

Figure 9. Average GT scores by gender and accession cohort, FY 1990 to FY 2013



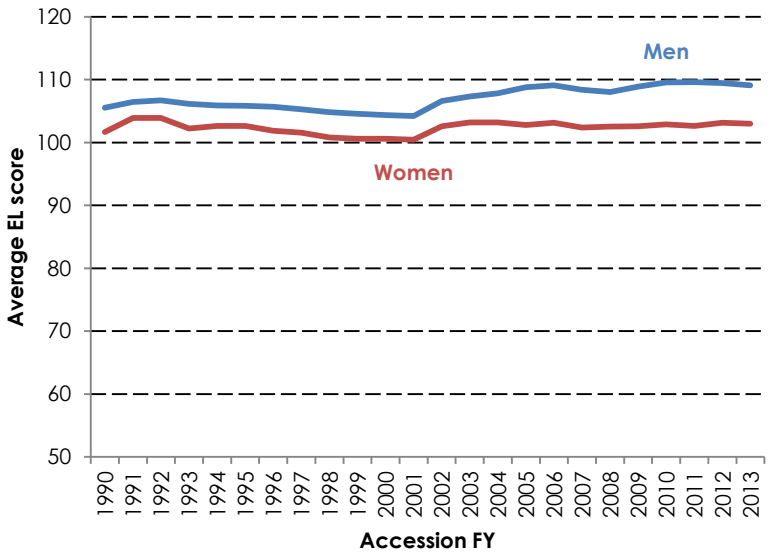
Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1989 through Sep. 2013.

Figure 10. Average MM scores by gender and accession cohort, FY 1990 to FY 2013



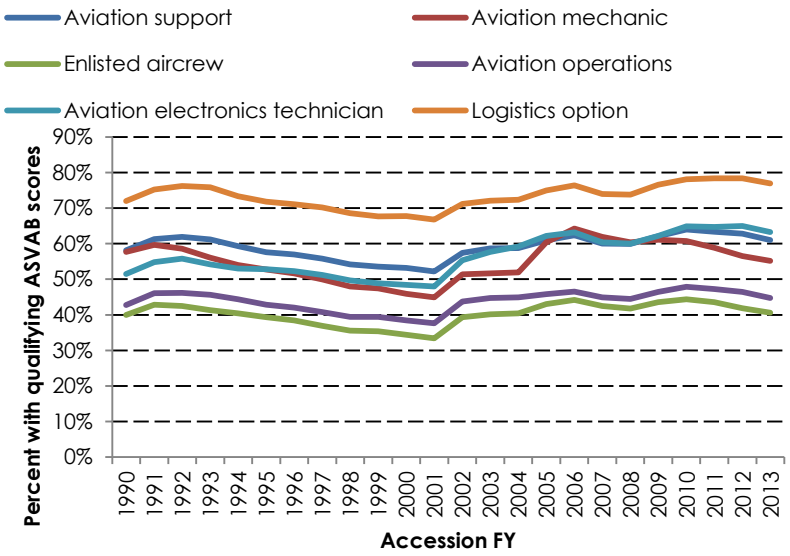
Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1989 through Sep. 2013.

Figure 11. Average EL scores by gender and accession cohort, FY 1990 to FY 2013



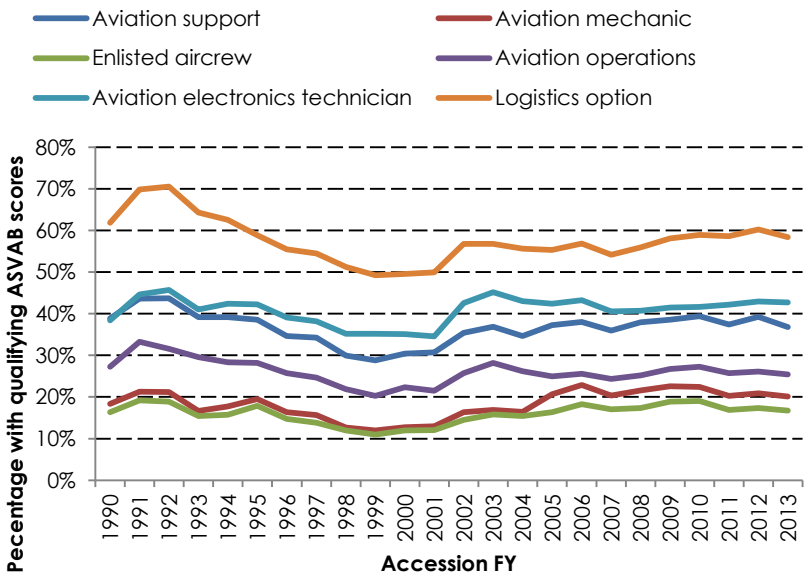
Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1989 through Sep. 2013.

Figure 12. Percentage of male enlisted recruits eligible for aviation and logistics PEFs, by PEF and accession cohort, FY 1990 to FY 2013



Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot files from Oct. 1989 through Sep. 2013.

Figure 13. Percentage of female enlisted recruits eligible for aviation and logistics PEFs, by PEF and accession cohort, FY 1990 to FY 2013



Source: CNA tabulations of MCTFS, ARMS, and MCRIS snapshot data from Oct. 1989 through Sep. 2013.

Summary

In this section, we examined gender differences in which recruits meet pilot and NFO requirements as well as the ASVAB requirements for the logistics and aviation PEFs. We found that women were less likely to earn FARs that qualified them for the pilot/NFO career track. We also found that women generally score lower on the technical sections of the ASVAB; this means that a smaller percentage of women than men will qualify for technical PEFs, such as the aviation and logistics PEFs. For ground combat occupations, the ASVAB requirement may not be as binding (e.g., the infantry PEF requires a GT of 80 or better). However, our findings indicate that some PMOS requirements may restrict the female recruiting pool for some occupations more than others. The Marine Corps will need to factor this relationship into its recruiting missions or decisions pertaining to changes in occupation-specific ASVAB requirements.

To receive a logistics or aviation PMOS, a recruit needs to pass PMOS training. In the next section, we look at male and female flight training completion rates.

Flight Training Completion Rates

The integration of ground combat occupations would require the integration of entry-level training for these occupations. The Marine Corps is currently conducting research about how men and women complete the physically demanding infantry training courses. Because flight training is a long and challenging process, it provides an interesting case study to highlight how men and women respond to an intense training pipeline. Flight training is not a substitute for ground combat occupation entry-level training, but it may provide insights that the Marine Corps may be able to apply to the ground combat community.

In this section, we look at flight training completion rates to see whether women are more likely or less likely to complete flight training and obtain a qualified pilot or NFO PMOS. Past studies on naval flight students have found that women, in general, are less likely than men to complete flight training [14-16]. If this holds true for Marine flight students, flight training may contribute to the relatively low female representation we observe in the pilot/NFO occfield.

Flight training

Once commissioned, it takes over one year of training for Marines to qualify as pilots and NFOs. Officers first complete 6 weeks of aviation preflight indoctrination in Pensacola, Florida, followed by 22 weeks of primary flight training. After primary flight training, officers go through advanced flight training, which can last 14 to 49 weeks for fixed-wing pilots and NFOs or 27 to 44 weeks for rotary-wing pilots. After advanced flight training, pilots receive additional platform-specific training. Once a Marine has competed flight training, he or she receives a platform-specific basic pilot/NFO PMOS. A Marine pilot's and NFO's service obligation begins after he or she completes flight training. Depending on the platform, pilots and NFOs must serve a minimum of six or eight years after they complete flight training. If a Marine fails to complete flight training, he or she trains for another PMOS and serves out the remainder of the service requirement according to his or her commissioning source (i.e., USNA graduates typically have five-year commitments, while other officers typically have four-year commitments).

MCTFS, ARMS, and MCRISS do not contain flight training data, so we cannot observe when Marines arrive in Pensacola, how long it took them to complete primary and advanced flight training, or the platform for which they trained. This prohibits us from analyzing how men and women perform while at flight school. However, we can observe when a Marine completed this training by when his or her PMOS changes from a student PMOS to a basic pilot or NFO PMOS.[15] For our analysis, we refer to those who received a basic pilot/NFO PMOS as having completed flight training.

Gender trends

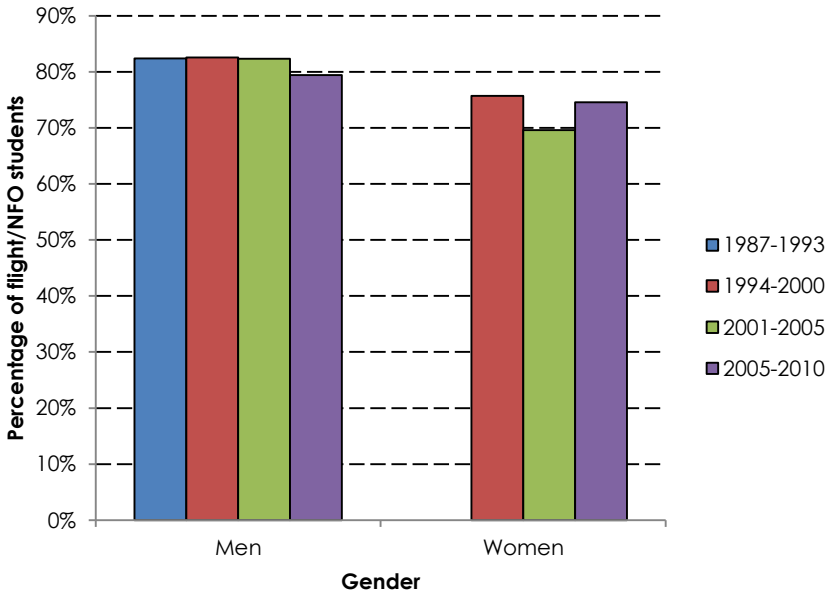
We tracked the careers of officers who were in aviation student PMOSs between FY 1994 and FY 2010. We restrict the population in this manner so that we can compare female officer outcomes with those of their male counterparts (there were no female aviation officers before FY 1994) and to allow some time to have elapsed for officers to complete flight training.[16]

Figure 14 shows the percentage of officers, by gender, who received a basic pilot/NFO PMOS and completed flight training over time. We find that roughly 79 percent of male officers and 70 percent of female officers completed flight training. We do not find any notable trends in the percentage of officers completing flight training over time. We do note that recent male cohorts have had lower flight training completion rates than previous cohorts, although we do not have enough data to determine whether this is a short-term or long-term trend. In addition, we find that the percentage of male officers who did not complete training and went into non-pilot/non-NFO aviation PMOSs has fallen over time, while the percentage who did not complete training and went into non-aviation PMOSs has increased. We do not find a similar trend for women.

[15] The flight student PMOS is 7599. There are two NFO student PMOSs: 7578, NFO student (TBS), and 7580, NFO tactical flight student.

[16] Ninety-five percent of aviation students received a basic pilot/NFO PMOS within four years.

Figure 14. Percentage of officers who completed flight training, by gender and FY of aviation student PMOS, FY 1987 to FY 2010



Source: CNA tabulations of MCTFS snapshot data from Sep. 1986 through May 2014.

Factors affecting flight training completion

To determine how much of the difference we observe between male and female flight training completion rates can be attributed to gender alone, we estimated the probability of completing flight training as a function of gender and other observable characteristics for the population of officers who entered aviation student PMOSs between FY 1987 and FY 2010.[17] The other characteristics in our equation included FAR, lateral entry into aviation student PMOSs, NFO student versus pilot student, having a first class physical fitness test (PFT) score, general classification test (GCT) scores, TBS class third, commissioning source, number of dependents at commission, age at commission, race/ethnicity, and FY of pilot/NFO student PMOS.[18] Our

[17] We ran a logistic regression to estimate the effect of Marines' observable characteristics on the probability of completing flight training. We use logistic regressions when we are trying to predict binary outcomes, such as completing flight training.

[18] Full regression results are provided in Appendix C.

estimates indicate that female officers were almost 7 percentage points less likely than male officers to complete flight training, which accounts for almost 78 percent of the observed difference in male and female flight training completion rates.

In addition to gender, previous research on naval aviators has shown that flight training completion rates vary by commissioning source and are positively correlated with ASTB FARs [16]. To better understand gender differences in Marine flight training completion rates, Table 3 shows mean characteristics for officers who entered pilot and NFO student PMOSs by flight training status. For example, 7.6 percent of male officers who completed flight training were NFO students and 10.0 percent of those who failed to complete flight training were NFO students (overall, 8.1 percent of men who entered flight training were NFO students). This suggests that male student NFOs are less likely to complete flight training than male student pilots.

We find that, for both men and women, those who successfully completed flight training generally had higher FARs, were in the top third of their TBS classes, and were white. These relationships between FARs, TBS third, and race/ethnicity persist even after controlling for other observable characteristics.

We also estimated the effects of these observable characteristics on flight training completion for male and female officers separately using logistic regression techniques; these results are provided in Appendix C. For both men and women, our estimates indicate that officers with FARs of 7 are roughly 5 percentage points more likely to complete flight training than officers with FARs of 6. We estimate that male officers with FARs of 8 or 9 are almost 9 percentage points more likely to complete training than male officers with FARs of 6. For women, we cannot estimate the increase in the probability of completing flight training if a female officer has a FAR of 8 or 9 because there is no variation in flight training completion; all female officers with FARs of 8 or 9 successfully completed training.

Our estimates indicate that black officers are less likely than white officers to complete flight training. Specifically, we estimate that, compared with white male officers, black male officers are 6 percentage points less likely to complete training, and black female officers are over 26 percentage points less likely to complete training (however, there are only 10 black females in the analytical population). Our estimates do not indicate significant differences between Hispanic and non-Hispanic officers or white and other-than-black minority officers.

Our estimates of the effect of TBS third on flight training completion indicate that those in the bottom third of their TBS classes are least likely to complete flight training relative to those in the top third. We estimate that male and female officers in the bottom third are 14 and 20 percentage points less likely to complete flight training than male and female officers who were in the top third of their TBS classes, respectively.

Table 3. Characteristics of pilot and NFO students, by gender and flight training status[a]

	Women			Men		
Characteristic	**All**	**Completed training**	**Failed training**	**All**	**Completed training**	**Failed training**
Student NFO	15.0%	15.5%	13.8%	8.1%	7.6%	10.0%
Lateral entry	3.2%	3.8%	1.8%	2.7%	2.7%	2.6%
FAR						
FAR 6	17.9%	18.1%	17.4%	20.0%	19.0%	23.6%
FAR 7	6.6%	7.1%	5.5%	12.1%	12.4%	11.0%
FAR 8 or 9	3.5%	5.0%**	0.0%	12.1%	13.1%	8.0%
No FAR	72.0%	69.7%	77.1%	55.8%	55.4%	57.3%
Age (years)	23.0	22.9%	23.0	23.4	23.3	23.7
Race/ethnicity						
Hispanic	2.9%	2.1%	4.6%	4.8%	4.3%	6.4%
White	86.2%	88.2%	81.7%	89.7%	90.8%	85.5%
Black	2.9%	1.3%	6.4%	2.8%	2.3%	4.8%
Other	11.0%	10.5%	11.9%	7.4%	6.8%	9.7%
Commission source						
USNA	35.2%	36.2%	33.0%	13.7%	14.4%	11.2%
NROTC	12.3%	11.2%	14.7%	12.4%	12.8%	10.8%
OCC	27.9%	27.6%	28.4%	22.4%	21.8%	24.8%
PLC	16.1%	16.4%	15.6%	43.4%	43.3%	43.9%
Enlisted	2.9%	2.6%	3.7%	5.3%	5.0%	6.5%
Other	5.6%	6.0%	4.6%	2.8%	2.8%	2.9%
Married	10.4%	10.9%	9.2%	18.2%	18.2%	18.3%
No. of dependents						
Zero	93.9%	93.7%	94.5%	81.3%	81.4%	81.2%
One	5.5%	5.9%	4.6%	12.8%	13.1%	11.8%
Two or more	0.6%	0.4%	0.9%	5.8%	5.5%	7.0%
1st Class PFT	95.2%	95.7%	93.8%	96.7%	96.9%	95.9%
GCT score	128.2	128.7	127.0	127.3	127.8	125.3
TBS						
Top third	26.1%	29.5%	17.7%	36.0%	38.8%	24.9%
Middle third	33.6%	36.3%	27.1%	35.6%	36.7%	31.5%
Bottom third	40.2%	34.2%	55.2%	28.4%	24.6%	43.6%
No. of observations	347	238	109	10,481	8,303	2,178

Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Mar. 2014.

a. Percentages may not add to 100 because of rounding.

Summary

In this section, we examined gender differences in flight training completion. We estimated that gender explained over half of the difference in male and female flight training completion rates. We also found that officers in the top third of their TBS classes or those with high FARs were significantly more likely to complete flight training. Requiring higher FARs or requiring officers to be in the top two-thirds of their TBS classes before selection into aviation PMOSs could increase flight training completion rates for both women and men. Before adopting such policies, however, the Marine Corps would need to assess how these changes would affect the total number of Marines interested in entering these occupations because increasing requirements will result in fewer candidates being eligible to serve in these occupations. Because the number of women in pilot/NFO PMOSs is not large, decreases in the size of the candidate pool likely will be proportionally larger for women than for men; that is, the female candidate pool likely will shrink by a larger percentage than the male candidate pool.

In the next section, we continue our analysis of male and female performance by examining retention and promotion rates.

Officer Retention and Promotions

In this section, we examine retention and promotion trends for pilots/NFOs, non-pilot/non-NFO aviation officers, and logistics officers, highlighting any differences between men and women.

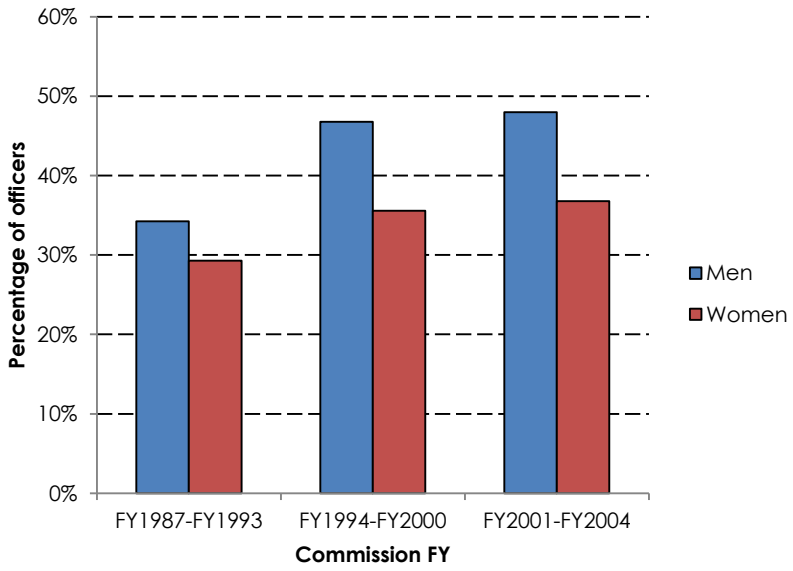
Retention

In Figure 15 and Figure 16, we show the percentage of logistics and aviation officers who made it to 10 years of commissioned service (YCS), calculated as the number of years since commissioning. We grouped Marines by their first non-training-related PMOS.[19] The vast majority (95 percent) of officers received a non-training-related PMOS within the first 4 YCS. Therefore, we examine retention to 10 YCS conditional on making it to 4 YCS.[20] Overall, 43 percent of male logistics officers, 35 percent of female logistics officers, 47 percent of male aviation officers, and 27 percent of female aviation officers reached 10 YCS. We find similar differences in male and female retention rates when we examine all officers: Logistics and aviation retention to 10 YCS is lower than the Marine Corps' overall male and female officer retention rates: 50 percent of male officers and 35 percent of female officers reached 10 YCS. This finding differs from previous research on naval aviator retention, which shows that female naval aviator retention is more similar to overall male retention than overall female retention [17-18].

[19] Training PMOSs include XX01 PMOSs, flight/NFO student PMOSs, and basic officer PMOSs.

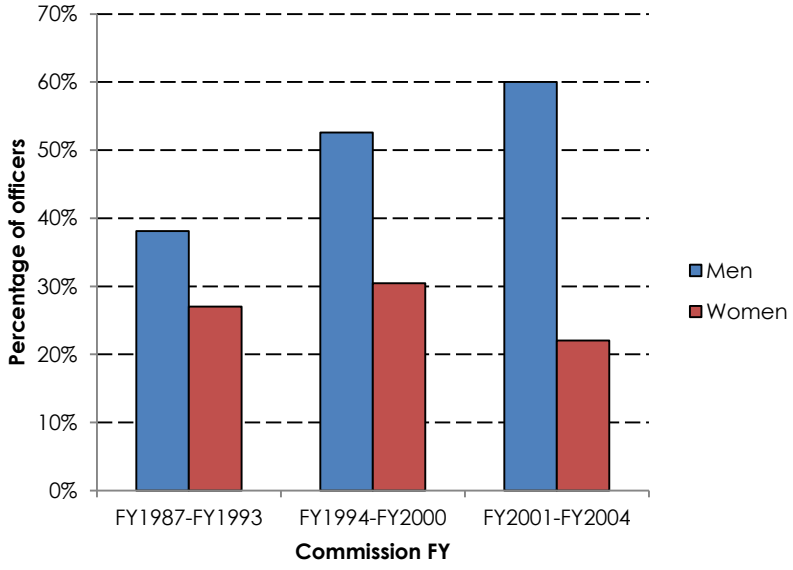
[20] Our method of identifying the population of interest is similar to that used by Parcell et al. to analyze predictors of Navy officer success [17].

Figure 15. Logistics officer 10-YCS retention rates, by gender and commission FY



Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Mar. 2014.

Figure 16. Aviation officer 10-YCS retention rates, by gender and commission FY

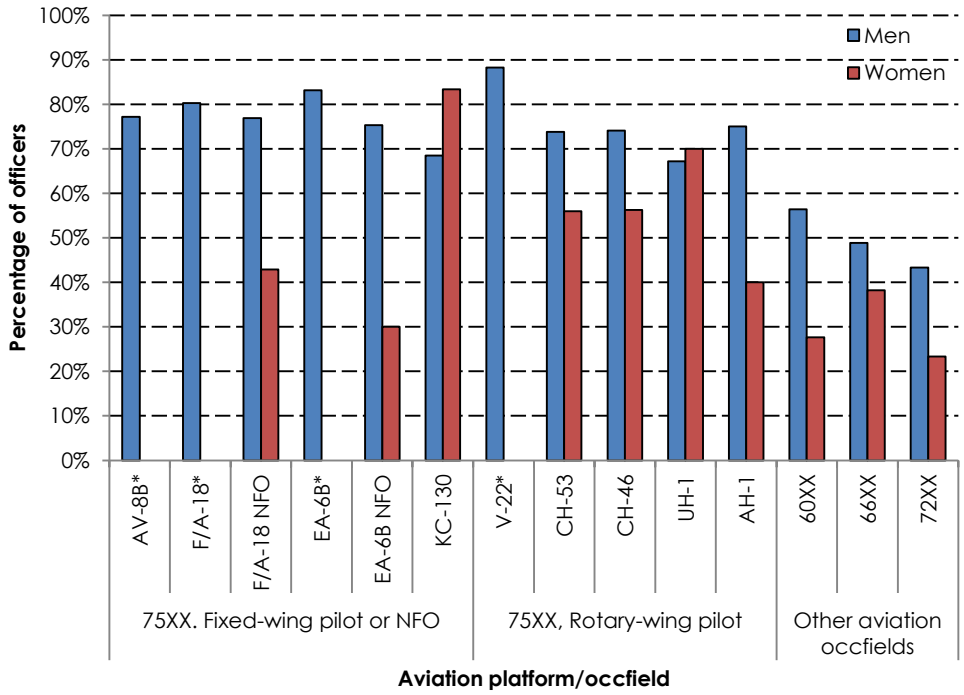


Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Mar. 2014.

Female officers in aviation and logistics occupations are less likely to reach 10 YCS than their male peers, but the difference between male and female retention rates is largest for those in aviation occupations. For both communities, we find that the 10-YCS retention rate increased over the analysis period for both men and women; however, the gender gap does not appear to have closed with time or with an increase in female representation.

To better understand how male and female retention rates differ across aviation occupations, Figure 17 shows the percentage of male and female officers who reached 10 YCS by occfield and aviation platform. From the figure, we see that female representation is low for some platforms: there were fewer than five female officers who were qualified AV-8B, F/A-18, V-22, or EA-6B pilots. Therefore, we do not report female retention rates for platforms. For the most part, female aviators were NFOs (F/A-18 and EA-6B) or rotary-wing pilots (the CH-53, UH-1, and AH-1 platforms).

Figure 17. Aviation officer 10-YCS retention rates, by gender and occupation[a]



Source: CNA tabulations of MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Mar. 2014.

[a] Platforms marked with an asterisk (*) had fewer than five female officers, so we do not report female retention rates.

Focusing first on female aviation retention rates, we see in Figure 17 that female NFOs are less likely to reach 10 YCS than female rotary-wing pilots. Female officers with 60XX, 66XX, or 72XX PMOSs appear to have lower retention rates than female rotary-wing pilots, but they have similar rates to female NFOs. Turning to male retention rates, we see that male fixed-wing pilots (AV-8B, F/A-18, EA-6B, and KC-130) generally have higher 10-YCS retention rates than male rotary-wing pilots, and rotary-wing pilots appear to have higher retention rates than male officers in non-pilot/non-NFO PMOSs (60XX, 66XX, and 72XX). Some differences in retention rates may be attributed to differences in the service-length requirements for fixed-wing, rotary-wing, and other PMOSs; fixed-wing pilots typically have the longest obligations, followed by rotary-wing pilots, NFOs, and other officers.

To determine how much of the difference in male and female retention rates can be attributed to gender alone, we estimated the probability of a Marine officer reaching 10 YCS as a logistic function of gender and other observable characteristics (results are presented in Appendix D). These characteristics include an indicator for whether the officer made a lateral move to another PMOS, GCT score, PFT score at 4 YCS, TBS third, commission source, age at commission, marital status, number of dependents at commission, race/ethnicity, and commission FY. In the aviation models, we also controlled for FAR and platform/occfield. After controlling for these observable characteristics, we find no significant difference in the probability of reaching 10 YCS between male and female logistics officers. However, we estimate that female aviation officers are almost 20 percentage points less likely to reach 10 YCS than male aviation officers, which accounts for almost two-thirds of the raw difference in male and female aviation 10-YCS retention rates.

We also estimated separate equations for each gender-occupational group: male logistics officers, female logistics officers, male aviation officers, and female aviation officers. Overall, the female-only models do not yield many statistically significant results, likely because there are few women in these occupations and, therefore, there is not enough variation in retention behavior or observables to measure differences. This is not the case for the male equations. In Table 4, we highlight some of the statistically significant estimates from the gender-specific regression models (full results are in Appendix D). Specifically, Table 4 shows the percentage-point change in the 10-YCS retention rate associated with the variable of interest. For example, women who made a lateral move out of a logistics PMOS are 32.3 percentage points less likely to reach 10 YCS than women who stayed in their logistics PMOSs; men who made a lateral move out of a logistics PMOS are 53.6 percentage points more likely to reach 10 YCS than men who stayed in their logistics PMOSs.

Table 4. Estimated percentage-point change in the probability of reaching YCS 10, by occupation and gender

	Logistics		Aviation	
Explanatory factor	**Women**	**Men**	**Women**	**Men**
Lateral move	+32.3*	+53.6**	+38.2**	+19.8**
GCT score	-0.5	-0.3**	-0.4	-0.01**
1st Class PFT	-11.1	+8.9**	+3.1	+5.2**
TBS class third (top third omitted)				
Middle third	-11.0	+0.01	+1.40	-3.9**
Bottom third	-4.2	-6.7*	+1.2	-8.5**
Age at commission	+4.3**	+2.9**	+1.9	+1.1**
Commission source (USNA omitted)				
NROTC	+3.1	-2.6	-6.2	+1.7
OCC	-7.4	-8.1*	-17.7	-6.8**
PLC	-1.2	-7.7*	-17.3	-5.0**
Prior-enlisted	+23.0	+11.0*	+7.1	+11.9**
Other	+19.2	+6.4	-16.2	+1.3
Married at commission	+3.3	+26.3**	+19.4	-2.8
No. of dependents				
One	+26.0	-13.2	+14.3	+8.6
Two or more	-25.5	-8.0	-39.6	+16.6**
Hispanic	+19.0	-16.2**	-20.3	+0.3
Race (white omitted)				
Black	-33.0	+2.7	+10.5	+1.0
Other	-7.5	+10.7**	+4.6	+2.6
Number of observations	202	1,334	256	6,222

Source: CNA estimates based on MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Mar. 2014.

** Indicates that the point estimate is statistically different from 0 at the 5-percent level.

* Indicates that the point estimate is statistically different from 0 at the 10-percent level.

For both male and female logistics and aviation officers, Marines who trained in another PMOS (that is, they laterally moved out of their first non-training-related PMOS) and those who have 1st Class PFT scores are more likely to reach YCS 10. A lateral move comes with a minimum service requirement, so these officers may need to stay past 10 YCS to meet their obligations.

We also find that male logistics officers and female aviation officers who are married at commissioning were more likely to reach 10 YCS than officers who were single. The difference between the effect of marital status on the probability of reaching 10

YCS for female logistics officers and female aviation officers may be due to differences in the logistics and aviation career paths. Pilots need to maintain currency by meeting minimum flying requirements. If family needs (e.g., pregnancy) are more likely to take women out of the cockpit, it may be harder for them to maintain the work-life balance that they need to be successful at home and in the Marine Corps.[21]

Our estimates indicate that, compared with USNA officers, those commissioned through the PLC or OCC programs are less likely to reach 10 YCS, while those who were prior enlisted are more likely to reach 10 YCS. Although the point estimates are significant only for the male equations, the female point estimates have similar signs. Commissioning source differences in retention behavior may be the result of different service obligation requirements, but some of the differences may be due to other unobservable differences between Marines who were commissioned through different channels.

Promotions

A Marine's career longevity relies on his or her ability to be promoted. That is, the Marine Corps, like the other military services, requires Marines to be promoted to the next rank within a certain amount of time in order to be eligible to stay in the Marine Corps. In the previous retention analysis, we were not able to separate losses due failures to promote from personal decisions to separate. In this subsection, therefore, we look at promotion rates, by gender, to determine whether the differences between male and female retention behavior that we observed are the result of women being promoted at different rates than men.

In Table 5, we show the percentage of officers selected for promotion to the ranks of captain (Capt), major (Maj), and lieutenant colonel (LtCol). For officers commissioned between FY 1987 and FY 2013, we constructed promotion cohorts and promotion selectees from data provided in Marine Corps administrative messages (MARADMINs). The selection rates in Table 5 are for the FY 1995 to FY 2015 Capt boards, the FY 1997 to FY 2015 Maj boards, and the FY 2003 to FY 2015 LtCol boards.[22]

[21] Although it is assumed that work-life balance is an issue affecting female Marines' continuation and retention decisions, little quantitative evidence exists. It is an area that warrants further study.

[22] We also examined the selection rates for the FY 2008 to FY 2015 colonel boards, but fewer than five female logistics and aviation officers were considered during this period.

Overall, the raw selection rates presented in Table 5 show that male and female officers were selected for promotion to Capt, Maj, and LtCol at roughly the same rates. For Marines in logistics and non-pilot/non-NFO aviation PMOSs, we find that women are selected for promotion to Capt and Maj at slightly higher rates than men; however, in LtCol boards, men seem to be favored. We find the greatest gender gap among non-pilot/non-NFO aviation officers being considered for promotion to LtCol: almost 68 percent of men were selected for promotion, while only 45 percent of women were selected.

Table 5. Officer promotion board selection rates (percentage selected for promotion), by rank, gender, and occupational group[a]

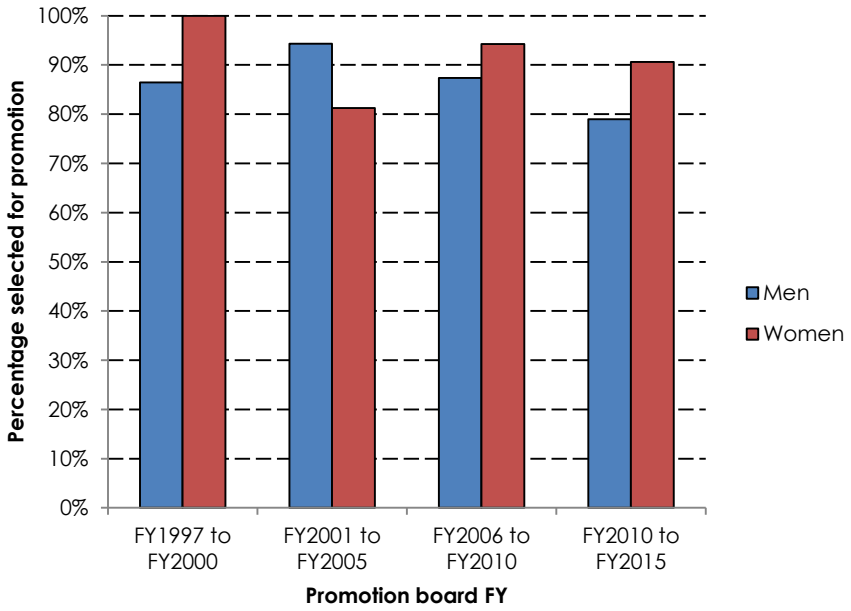
Promo-tion board	04, Logistics PMOSs		60XX-72XX, Non-pilot/ non-NFO PMOSs		75XX, Pilot/NFO PMOSs		All officers	
	Men	Women	Men	Women	Men	Women	Men	Women
Capt	97.5 (2,145)	98.0 (343)	96.7 (1,851)	97.9 (236)	99.6 (7,254)	98.8 (258)	97.4 (26,254)	97.7 (1,919)
Maj	87.1 (812)	91.0 (89)	84.2 (752)	89.1 (46)	79.7 (4,914)	78.7 (94)	83.6 (12,029)	85.2 (575)
LtCol	69.9 (432)	65.7 (35)	67.9 (331)	45.5 (11)	67.4 (205)	63.6 (11)	68.2 (5,451)	68.2 (170)

Source: CNA tabulations of MCTFS snapshot data from Oct. 1986 through Mar. 2014 combined with information from officer promotion board MARADMINs.

a. Numbers of observations are shown in parentheses.

In Figure 18 and Figure 19, we show the selection rates for Maj over time, by promotion board FY. We focus on Maj promotion boards because almost everyone considered for promotion to Capt is selected and there are not enough women in each FY group to produce meaningful trend analysis for the LtCol boards. We find that, over time, female selection rates for promotion to Maj have risen above those for men. For example, for the FY 2010 to FY 2015 Maj boards, 79 percent of male logistics officers and 75 percent of male pilots and NFOs were selected for promotion compared with 91 percent of female logistics officers and 85 percent of female pilots and NFOs.

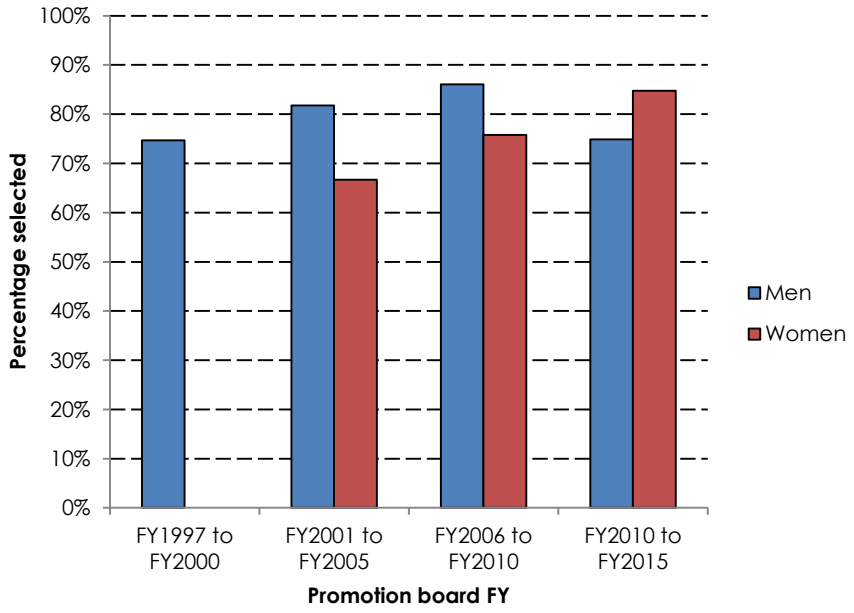
Figure 18. Major promotion board selection rates for logistics officers, by gender and FY of board



Source: CNA tabulations of MCTFS snapshot data from Oct. 1986 through Mar. 2014 combined with information from officer promotion board MARADMINs.

Promotion boards determine which Marines are the most qualified for promotion. To determine how much of the raw difference in promotion rates is attributed to gender, we estimate the probability of promotion to Capt and Maj as a logistic function of gender and other observable characteristics that have been shown to affect promotion, such as commission source, age at commission, 1st Class PFT, GCT scores, and TBS third (see [17]). When controlling for these other observable characteristics, we find that the differences between male and female selection rates for Capt, Maj, and LtCol are not statistically different from zero. We do find that 1st Class PFT and TBS third significantly affect selection to these ranks. Those with 1st Class PFT scores and those in the top third of their TBS classes are most likely to be selected for promotion.

Figure 19. Major promotion board selection rates for pilots and NFOs, by gender and FY of board[a]



Source: CNA tabulations of MCTFS snapshot data from Oct. 1986 through Mar. 2014 combined with information from officer promotion board MARADMINs.

[a.] No women were considered until FY 2003.

Other factors may contribute to a Marine's promotion competitiveness, such as attendance at a top-level school (e.g., command and staff college or a war college). Typically, Marines will attend command and staff college between 10 and 15 YCS and a war college sometime later. Although the female logistics and aviation populations that reached 10 or more YCS are too small for us to analyze attendance rates by gender, results from the 2012 and 2013 Commandant's career-level education board (CCLEB) and professional intermediate-level board (CPIB) show that female officers are more likely to be selected for these educational opportunities.[23] The FY 2013 CCLEB selected 23 percent of eligible female officers and 17 percent of eligible male officers for career-level education opportunities [19]. The FY 2013 CPIB selected 37

[23] CCLEB selects captains and lieutenants for such programs as the Expeditionary Warfare School, career captain courses, and advanced degree programs [19]. The CPIB selects majors to attend the various service schools and foreign professional military schools [20].

percent of eligible female officers and 23 percent of eligible male officers for professional intermediate-level education opportunities [20].

Under the assumption that promotion boards only select the highest quality Marines for promotion, the promotion selection rates that we observe do not indicate that female logistics and aviation officers are of lesser quality than their male counterparts. This suggests that the gender differences in retention rates that we observe are not the result of female officers not being promoted but rather women's choices to leave the AC.[24] Although female officers may be leaving the AC at higher rates than male officers, past research has shown that they are more likely to affiliate with the Marine Corps Selected Reserve after they transition [21].

Summary

We find that female logistics and aviation officers are less likely to reach 10 YCS than their male counterparts. We estimate that female logistics officers are no more or less likely to reach 10 YCS than male logistics officers, but female aviation officers are 20 percentage points less likely to reach 10 YCS than their otherwise identical male peers. We find little evidence to suggest that differences between male and female retention rates were the results of lower selection rates for promotion to captain, major, and lieutenant colonel. This suggests that female officers up for consideration by promotion boards were of high enough quality to compete. Furthermore, the similarities in promotion selection rates between male and female officers in logistics and aviation PMOSs suggest that women are not leaving these PMOSs because they are not competitive. The suggestion is that there are other factors, such as maintaining a work-life balance, that may affect women and their decisions to continuing serving in the AC. To better understand why officers, particularly women, choose to leave the AC, the Marine Corps should perform exit interviews with or administer an exit survey to Marine officers who are transitioning from the AC.

In the next section, we examine enlisted retention and promotion trends.

[24] We do not observe historical command screening results; however, in some discussions with subject matter experts, we heard that women were more likely than men to remove themselves from consideration for command, thus making them less competitive for promotion. This is additional evidence that women's career choices involve more than staying competitive for promotion.

Enlisted Attrition and Promotions

As we did for officers, our first performance outcome for analysis of enlisted performance in aviation and logistics PMOSs is retention. Typically, we measure enlisted retention in terms of first-term attrition and reenlistment rates. First-term attrition rates describe the percentage of enlisted recruits who do not complete their AC service requirement. For most enlisted Marines, this is a four-year commitment; however, some Marines are required to serve five years, depending on the training required for their PMOS assignments.

Attrition rates

To analyze attrition differences between men and women in aviation PMOSs, we examined the number of months from the active duty service date (ADSD) to the first aviation PMOS attainment date for Marines who entered the Corps between FY 1987 and FY 2014.[25] Of the 113,478 men and women whose first PMOS was in aviation, 98 percent of them had obtained the PMOS by 16 months of service. Thus, we start all of our attrition analyses for aviation PMOS Marines at 16 months of service.

Of the 14,155 Marines whose first PMOS was in logistics between FY 1987 and FY 2014, 98 percent obtained the PMOS by 12 months of service. Thus, we begin our comparison of male and female attrition rates in logistics PMOSs for those who received a logistics PMOS and reached 12 months of service.

For these populations, we analyze 24-, 44-, and 75-month attrition rates.

Aviation attrition

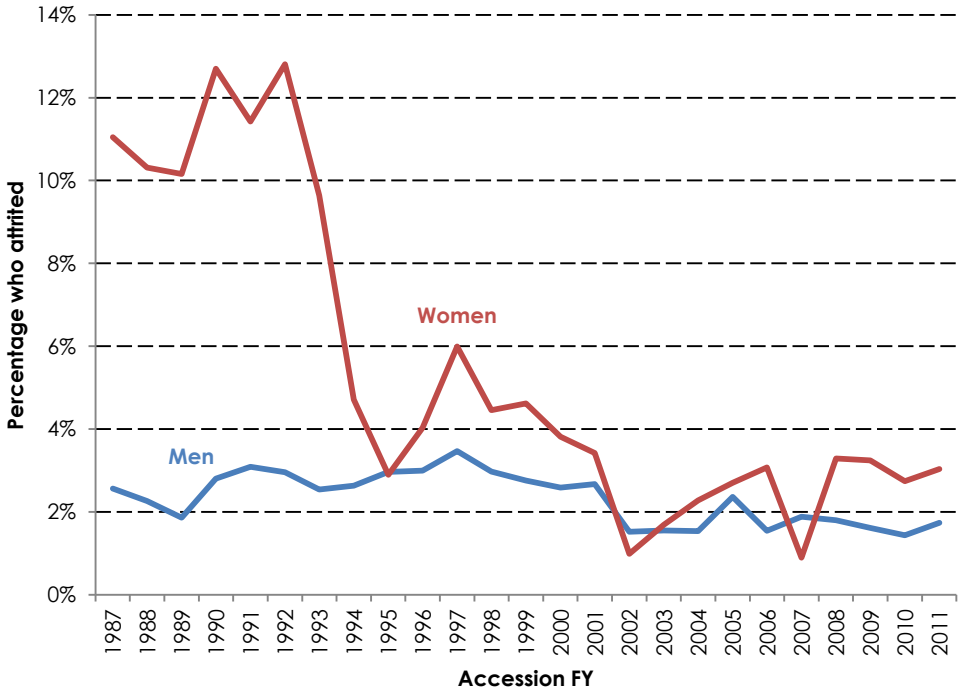
Figure 20 shows 24-month attrition rates for the 103,593 men and women who entered the Corps from FY 1987 through FY 2011, reached at least 16 months of service, and obtained an aviation PMOS.[26] Until FY 1995, women in aviation PMOSs

[25] We are looking for distributable PMOSs. We ignored the training PMOSs (XX00).

[26] Marines who accessed after FY 2011 have not yet reached 16 or 24 months of service.

had much higher attrition rates than men; since FY 1995, the rates have become more similar. We see a similar pattern in Figure 21 when we examine 44-month attrition rates.

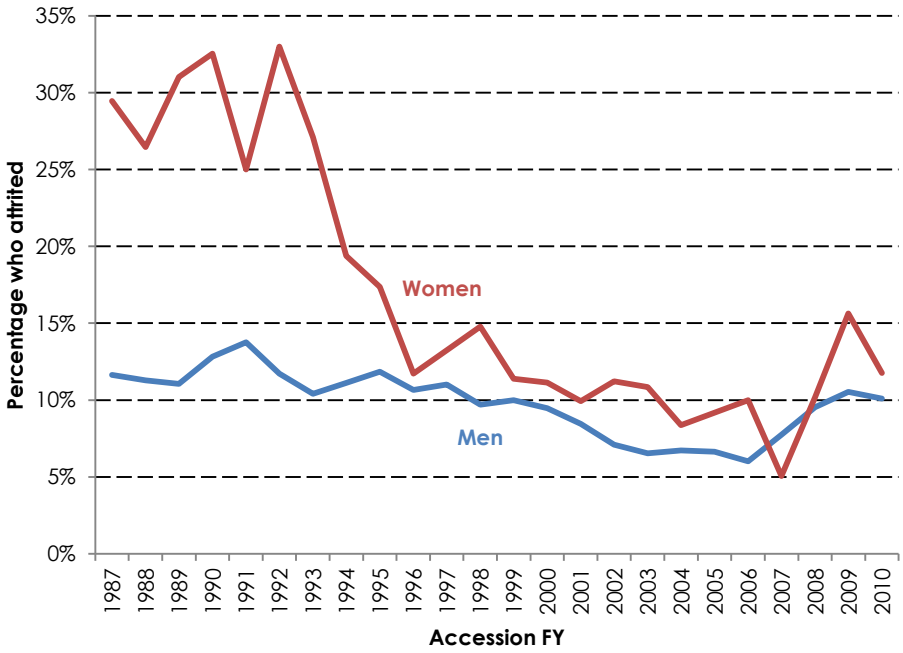
Figure 20. 24-month attrition rates for male and female Marines in aviation PMOSs, by FY of accession[a]



Source: CNA calculations of MCTFS, ARMS, and MCRISS snapshot data from FY 1987 through FY 2013.

[a] Attrition rates are conditional on a Marine continuing to 16 months of service and obtaining an aviation PMOS.

Figure 21. 44-month attrition rates for male and female Marines in aviation PMOSs, by FY of accession[a]

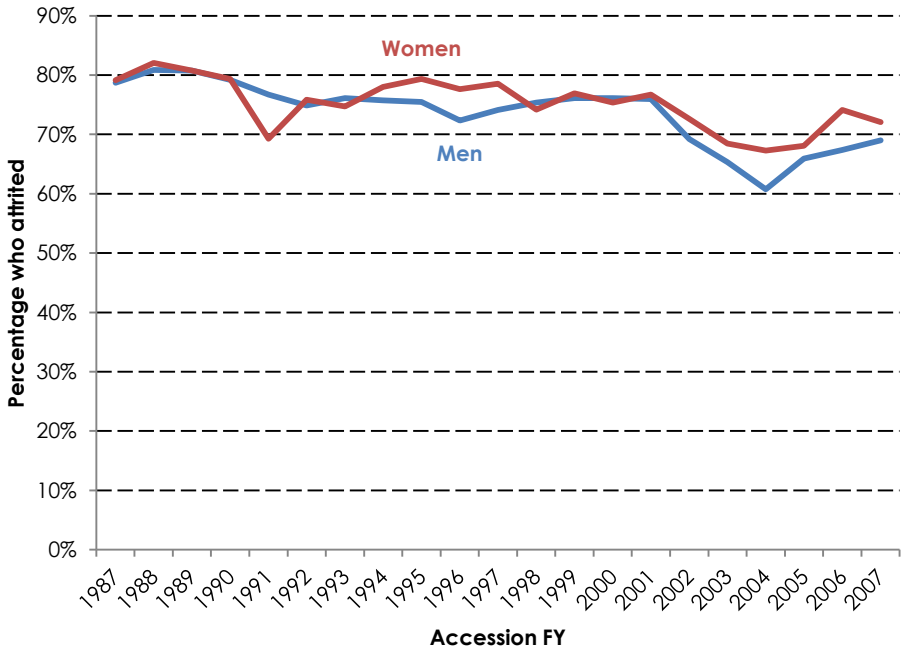


Source: CNA calculations of MCTFS, ARMS, and MCRISS snapshot data from FY 1987 to FY 2013.

[a.] Attrition rates are conditional on a Marine continuing to 16 months of service and obtaining an aviation PMOS.

Finally, we look at long-term attrition differences—end-of-active-service (EAS) and non-EAS differences from 16 months of service into the second term of service. Thus, we examine 75-month attrition rates for those who accessed between FY 1987 and FY 2007, again conditional on reaching 16 months of service and obtaining an aviation PMOS (see Figure 22). The differences between the female and male 75-month attrition rates are much smaller than the differences at 24 and 44 months of service. Given the very large attrition differences between men and women at the 24- and 44-month points, this finding means that women's long-term retention in aviation PMOSs is considerably higher than men's long-term retention—that is, the difference between the female 75-month and 44-month attrition rates is smaller than the difference between the male 75-month and 44-month attrition rates.

Figure 22. 75-month attrition rates for male and female Marines in aviation PMOSs, by FY of accession[a]



Source: CNA calculations of MCTFS, ARMS, and MCRISS snapshot data from FY 1987 to FY 2013.

[a.] Attrition rates are conditional on a Marine continuing to 16 months of service and obtaining an aviation PMOS.

To more fully explore gender differences in attrition for those in aviation PMOSs, we ran 44- and 75-month logistic regressions. We ran three specifications for each of these attrition periods: women only, men only, and men and women combined. The single-sex regressions allow us to look for any differences in the size and direction of the explanatory variables' effects on attrition, while the combined regression contains a shift variable for women but averages the effects of the explanatory variables for men and women. In each regression, we controlled for FY of accession and occfield as well as racial and ethnic background, high-quality recruits,[27] 5-year

[27] High-quality recruits are those who have Armed Forces Qualification Test (AFQT) scores in the 50th percentile or higher and hold high school diplomas. Historically, these recruits have had lower attrition than other recruits.

initial obligations,[28] age at accession, 3 months or more in the delayed entry program (DEP), and 1st Class PFT at 6 months of service.[29] In general, the direction of the effects of the explanatory variables on attrition for those in aviation PMOSs were similar for men and women.

In the 44-month attrition regression that pooled men and women in aviation PMOSs, the estimated percentage change in female attrition (relative to male attrition) was 6.1 percentage points. Actual 44-month attrition rates were 10 percent for men and 15 percent for women (this 5-percentage-point difference is not significantly different from the 6.1-percentage-point increase in attrition attributed to women in the combined regression). This suggests that the gender variable explains virtually the entire difference in 44-month attrition rates between men and women.

Table 6 shows the predicted percentage-point change in the 44-month attrition rate from the independent variables that were both statistically significant and of particular interest in the regressions for men and women in aviation PMOSs.

Table 6. Percentage-point change in 44-month attrition rate predicted from male and female logistic regressions for those in aviation PMOSs

Explanatory variable	Women	Men
1st Class PFT (at 6 months of service)	-12.4**	-8.4**
High-quality recruit	-3.1**	-1.5**
3 or more months in DEP	-2.8**	-3.0**
Race/ethnicity		
Hispanic	-4.7**	-2.2**
Black	-4.2**	+3.0**
Other race	-5.7**	-1.5**
Occfield		
62, Aircraft maintenance (fixed-wing)	+3.7*	+1.1**
72, Air control	+4.4*	+3.1**

Source: CNA estimates of MCTFS and MCRISS snapshot data from Oct. 1986 to Mar. 2014.

** Indicates that the point estimate is statistically different from 0 at the 5-percent level.

* Indicates that the point estimate is statistically different from 0 at the 1-percent level; results that are statistically different for male and female Marines are shaded.

Previous longer term attrition analyses generally had not examined the relationship between physical fitness and attrition, although some recent work has validated its importance for recruit training [22-23]. Given those findings and the current interest,

[28] Aviation contracts are split between 4-year and 5-year contracts.

[29] See Appendix E for full regression results.

particularly in women's physical fitness, we felt it was important to see if there was any relationship between physical fitness and longer term attrition. We use an indicator variable for those Marines who had 1st Class PFT scores six months after recruit training.[30] We posit that a 1st Class PFT after the completion of recruit training indicates a good job match, something that should predict lower attrition. In this population of Marines with aviation PMOSs, roughly 42 percent of women and 36 percent of men had a 1st Class PFT at the 6-month point. Women with 1st Class PFTs had 44-month attrition rates that were 12.4 percentage points lower, and men had rates that were 8.4 percentage points lower than those of their same gender without 1st Class PFT scores. The magnitude of this attribute on subsequent attrition dwarfs the effects of the other explanatory variables.[31]

High-quality recruits and those with 3 or more months in the DEP have lower attrition [22, 24-26]. In general, minorities have lower attrition, and these effects are particularly strong for women [24-25]. Hispanic women had predicted attrition rates 4.7 percentage points below those of non-Hispanic women (Hispanic men had predicted rates 2.2 percentage points below those of non-Hispanic men). While black women had predicted attrition rates 4.2 percentage points below the omitted category of white women, black men had higher predicted attrition rates than white men. There was little variation in attrition by aviation occfield, although both men and women in occfield 61, aircraft maintenance (fixed-wing), and occfield 72, air control, had statistically significantly higher attrition rates than Marines in the omitted occfield 60, aircraft maintenance; these higher rates for men and women were not statistically different from each other. We also tested whether the male and female coefficients were statistically different from each other: the only coefficients that were statistically different for men and women were the coefficients for black and other races.[32]

[30] Marine Corps recruit training is 13 weeks. A small number of recruits will be held back and may still be in recruit training at the 6-month point, but most recruits have completed recruit training by 6 months of service.

[31] We also ran a 44-month regression for all enlisted personnel who had completed 12 months of service; 34 percent of Marines had a 1st Class PFT at 6 months of service. The regression controlled for occfield in addition to the explanatory variables in the regressions described above. The marginal effect for having a 1st Class PFT at 6 months of service was an 11-percentage-point drop in 44-month attrition for men and a 12.5-percentage-point drop for women. This regression is available from the authors on request.

[32] In addition to the regressions reported in Appendix E, we ran regressions with a complete set of interaction terms to see if the estimated effects for men and women were statistically different from each other. These results indicate that the estimated coefficients for men and women in occfield 63 were statistically different at the 10-percent level, and the estimated coefficients for men and women in occfields 64 and 65 were statistically different at the 1-percent level.

Appendix E details the 75-month attrition regressions for men and women in aviation PMOSs. We find that the same explanatory variables that were important for understanding 44-month attrition (shown in Table 6) are important for predicting 75-month attrition rates. Overall, 75 percent of women and 74 percent of men in aviation PMOSs who reached at least 16 months of service attrited by 75 months of service. At 75 months of service, Marines who continued to this point are in the career force: they did not attrite during their first term of service and they have successfully reenlisted.

Interestingly, again the explanatory variable with the largest impact on 75-month attrition for those in aviation PMOSs was the indicator variable for 1st Class PFTs at 6 months of service. The 75-month attrition rates were 25.5 percentage points lower for women and 27.3 percentage points lower for men if they had scored 1st Class PFTs at the 6-month point in their Marine Corps careers. Less than half of recruits who graduate from recruit training achieve a 1st Class PFT. Those who do, however, are signaling a good job fit and an indication that they will continue to do well in the Corps. These effects are similar for men and women and, in our tests for differences in the effects of the explanatory variables; we did not find statistically different effects for men and women for the 1st Class PFT variable.[33]

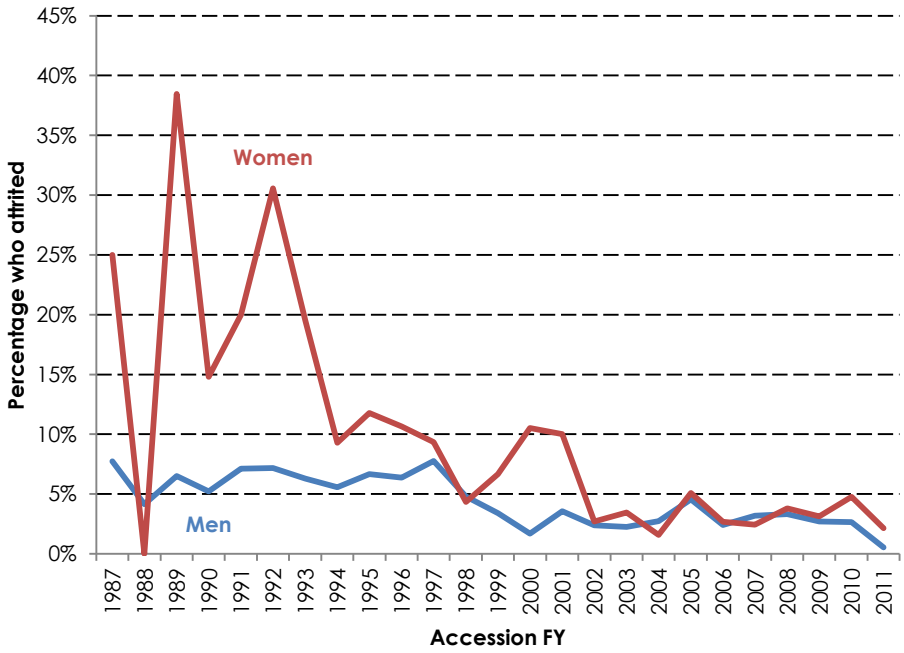
Logistics attrition

Figure 23 shows 24-month attrition rates for these Marines.[34] Again, we find that, before the mid-1990s, women in logistics PMOSs had much higher early attrition rates than their male counterparts.

[33] These results for 1st Class PFT at 6 months held up in the 75-month attrition regression for all Marines. Marines who had 1st Class PFTs at 6 months were 29 percentage points less likely to attrite at 75 months of service than those with other PFT scores. Overall attrition at 75 months of service was 79 percent.

[34] For FY 1988 accessions, 17 women received logistics PMOSs by 12 months of service. The 24-month attrition rate we calculate for these women is zero (none attrited between the 12th and 24th month of service).

Figure 23. 24-month attrition rates for male and female Marines in logistics PMOSs, by FY of accession[a]

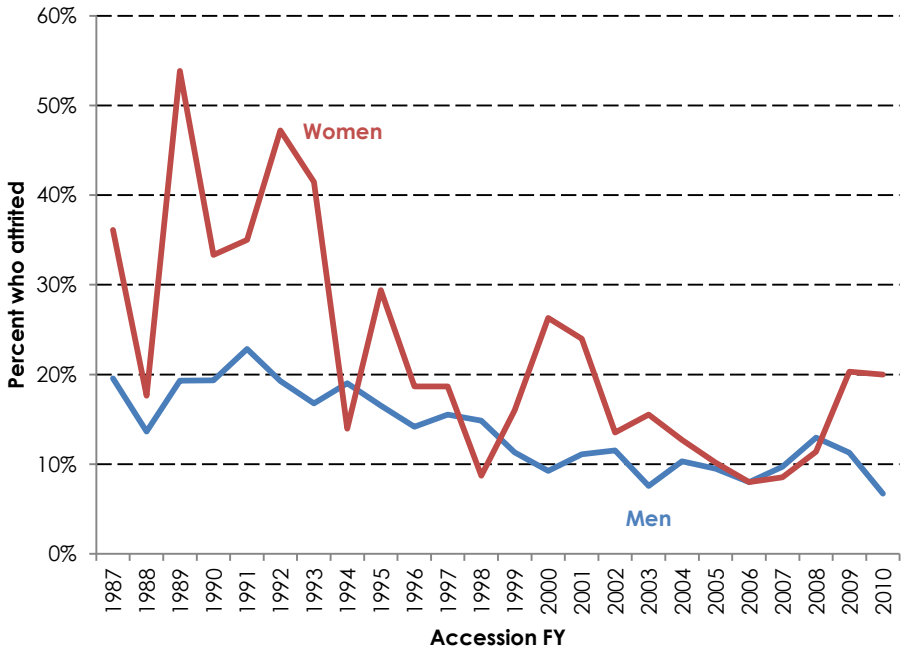


Source: CNA calculations of MCTFS, ARMS, and MCRISS snapshot data from FY 1987 through FY 2011.

[a.] Attrition rates are conditional on a Marine continuing to 12 months of service and obtaining a logistics PMOS.

Marines in logistics PMOSs have 4-year initial enlistment contracts. Because there were large numbers of "early-outs" in several years, we calculate first-term attrition for these Marines at 44 months of service (see Figure 24). In Figure 24, gender differences are smaller than they were at 24 months, but there are still some gender differences in attrition rates. If, however, we go beyond the first term of service and examine attrition differences at 75 months of service, we see that gender differences have virtually disappeared (see Figure 25). Again, this is because retention rates for women beyond the first term of service are substantially higher than the rates for men.

Figure 24. 44-month attrition rates for male and female Marines in logistics PMOSs, by FY of accession[a]



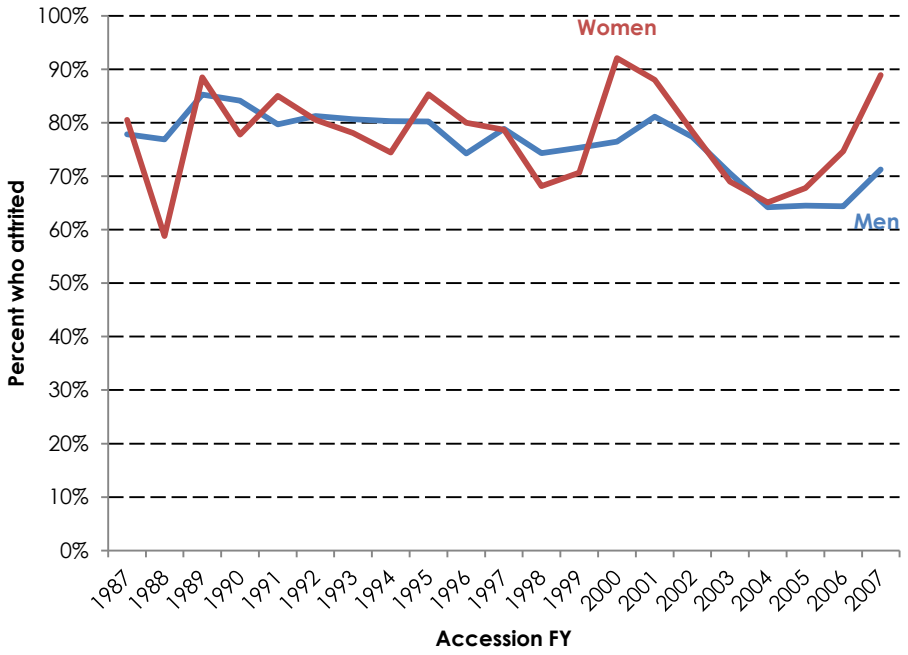
Source: CNA calculations of MCTFS, ARMS, and MCRISS snapshot data from FY 1987 through FY 2011.

[a.] Attrition rates are conditional on a Marine continuing to 12 months of service and obtaining a logistics PMOS.

Table 7 shows the statistically significant estimates from the 44-month attrition regressions for men and women in logistics PMOSs.[35] As with Marines in aviation PMOSs, 1st Class PFTs at the 6-month point are a critical indicator of a good job match and significantly lower attrition risk (see Table 6). Neither high-quality backgrounds nor 3 months in the DEP are statistically significant for women in logistics PMOSs, although they are associated with statistically lower 44-month attrition for men. Black and Hispanic women have statistically significant 44-month attrition rates that are more than 7 percentage points lower than those for white women, while the rates for black and Hispanic men are at least 4 percentage points below those for white men. Relative to white men or women, there is no statistically significant difference in the attrition rate of those of other races.

[35] Full regression results are provided in Appendix E.

Figure 25. 75-month attrition rates for male and female Marines in logistics PMOSs, by FY of accession[a]



Source: CNA calculations of MCTFS, ARMS, and MCRISS snapshot data from FY 1987 through FY 2011.

[a.] Attrition rates are conditional on a Marine continuing to 12 months of service and obtaining a logistics PMOS.

Table 7. Percentage change in 44-month attrition rate predicted from male and female logistic regressions for those in logistics PMOSs

Explanatory variable	Women	Men
1st Class PFT (at 6 months of service)	-17.0**	-11.0**
High-quality recruit	+1.3	-1.9**
3 or more months in DEP	-3.3	-3.6**
Race/ethnicity		
Hispanic	-7.2**	-4.8**
Black	-7.6**	-4.0**
Other race	+2.5	+0.5

Source: CNA estimates of MCTFS and MCRISS snapshot data from Oct. 1986 to Mar. 2014.

** Indicates that the point estimate is statistically different from 0 at the 5-percent level.

* Indicates that the point estimate is statistically different from 0 at the 1-percent level.

Over 77 percent of women and 76 percent of men in logistics PMOSs who reached 12 months of service attrited by 75 months of service. Once again, we find that the most important variable predicting lower 75-month attrition (and career force retention) is the indicator variable for 1st Class PFTs at 6 months of service. Attrition rates for both men and women in logistics PMOSs were 27 percentage points lower for those with early 1st Class PFT scores. In addition, black and Hispanic Marines have particularly low 75-month attrition rates. For high-quality Marines in logistics PMOSs, the results are mixed: high-quality women are more likely to leave the Corps by 75 months of service, whereas there is no statistical difference in the attrition rates for high-quality and lower quality male Marines.

Summary

Table 8 summarizes the average attrition rates by months of service for men and women who entered aviation and logistics PMOSs since FY 1987. The table adds information for 36-month and 56-month attrition rates that reinforces the earlier figures: women generally have early attrition rates that are higher than those for men, but these differences disappear when we look at long-term attrition rates. At 75 months of service, between 74 and 76 percent of accessions (who accessed between FY 1987 and FY 2009) had attrited from the Marine Corps, either as non-EAS or as EAS separations.

Table 8. Summary of gender differences in attrition rates (percentage who attrited), by months of service, aviation and logistics PMOSs[a]

Accession FY	Months of service	Aviation attrition rates		Logistics attrition rates	
		Women	Men	Women	Men
FY 1987 to FY 2011	24	4.6	2.3	7.9	4.4
FY 1987 to FY 2010	36	10.9	6.6	14.9	10.4
FY 1987 to FY 2010	44	15.0	9.7	19.1	13.9
FY 1987 to FY 2009	56	48.6	36.1	71.6	70.5
FY 1987 to FY 2007	75	74.9	73.6	75.7	76.2

Source: CNA estimates based on MCTFS and MCRISS snapshot data for Oct. 1986 through Mar. 2014.

a. Attrition rates are conditional on receiving an aviation (logistics) PMOS and completing 16 months (12 months) of service.

Promotions

We turn next to the probability of promotion to E4, E5, or E6 for enlisted men and women who entered the Marine Corps since FY 1987 and obtained aviation and logistics PMOSs by 16 and 12 months, respectively. For E4 promotions we analyze Marines who entered the Corps from FY 1987 to FY 2011, for E5 promotions we

analyze those who entered from FY 1987 to FY 2008, and for E6 promotions we analyze Marines who entered from FY 1987 to FY 2005.

Recall that all analyses are conditioned on at least 16 months of service for those in aviation PMOSs and 12 months of service for those in logistics PMOSs. Other sources that calculate promotion probabilities from the accession point will have considerably lower promotion probabilities because significant numbers of Marines attrite in the first year or 16 months of service. In particular, since female Marines have higher initial attrition rates than male Marines, female promotion probabilities would be considerably lower if we measured them from accession. At accession, however, it is unknown which recruits will attain logistics or aviation PMOSs.[36]

Promotion rates

Overall promotion probabilities for enlisted Marines in logistics PMOSs were as follows:

- E4 promotion probabilities: 76.4 percent for women, 76.3 percent for men
- E5 promotion probabilities: 31.6 percent for women, 31.6 percent for men
- E6 promotion probabilities: 13.4 percent for women, 13.7 percent for men

Overall promotion probabilities for enlisted Marines in aviation PMOSs were as follows:

- E4 promotion probabilities: 76.7 percent for women, 78.9 percent for men
- E5 promotion probabilities: 40.3 percent for women, 44.2 percent for men
- E6 promotion probabilities: 13.0 percent for women, 14.6 percent for men

Also, we examined promotion probabilities by aviation occfield, and we present these results in Table 9.

Men have higher E4 promotion probabilities in 7 of the 11 aviation occfields, higher E5 promotion probabilities in 6 of the 11 aviation occfields, and higher E6 promotion probabilities in 8 of the 11 aviation occfields. Promotion probability results in the logistics occfield were similar for men and women.

[36] We do not analyze Marines with intended logistics and aviation PMOSs (e.g., XX00 PMOSs).

Table 9. Probability of promotion, by aviation occfield and gender[a]

Occfield	E4		E5		E6	
	Women	Men	Women	Men	Women	Men
60, Aircraft maintenance	81.4	81.1	40.2	43.4	13.9	14.7
61, Aircraft maintenance (rotary-wing)	69.8	76.7	45.9	50.9	11.1	16.6
62, Aircraft maintenance (fixed-wing)	78.6	80.7	53.1	52.3	11.8	14.0
63, Organizational avionics maintenance	73.3	80.2	45.9	49.9	12.3	15.6
64, Intermediate avionics maintenance	73.5	77.0	47.0	46.6	14.3	13.7
65, Aviation ordnance	74.0	78.8	29.4	35.3	9.6	12.7
66, Aviation logistics	80.7	77.3	38.0	36.7	15.1	14.1
68, METOC	66.7	74.7	35.2	43.4	15.1	20.4
70, Airfield services	76.4	76.5	34.9	32.9	12.5	11.5
72, Air control	78.2	77.9	45.6	43.3	14.1	14.2
73, Enlisted flight crew	78.1	81.6	37.3	43.8	12.4	18.6
All aviation occfields	76.7	78.9	40.3	44.2	13.0	14.6

Source: CNA calculations based on MCTFS, ARMS, and MCRISS snapshot data from Oct. 1987 through Sep. 2013. T

[a]. These promotion probabilities are conditional on Marines reaching to 16 months of service and obtaining an aviation PMOS. E4 promotion probabilities are for FY 1987 to FY 2011 accessions, E5 promotion probabilities are for FY 1987 to FY 2008 accessions, and E6 promotion probabilities are for FY 1987 to FY 2005 accessions.

In summary, male Marines in aviation PMOSs generally have higher promotion probabilities than female Marines, but overall differences are small. For some aviation occfields, however, the probabilities of promotion for men are substantially higher than for women: occfield 61, aircraft maintenance (rotary-wing); occfield 63, organizational avionic maintenance; occfield 68, METOC; and occfield 73, enlisted flight crews.

Time to promotion

We next look at the speed of enlisted promotions to determine if women are faster or slower to promote than their male peers. In the enlisted force, promotion slots each year are determined by PMOS vacancies in the specified grade. Selection of those who will promote to E4 and E5 are determined by cutting scores, while selections to E6 are determined by a promotion board [27]. For all of these promotions, however, Marines with the best records are promoted first.

Some PMOSs have slower promotions and others have faster promotions. For our analysis, we are not interested in which PMOSs are fast promoters and which are slower promoters. Rather, we are interested in knowing within each fiscal year and PMOS *which Marines were promoted fastest and which were promoted slowest.* We assume that the highest quality Marines are promoted fastest.

Since there is considerable dispersion in the time to promotion, even for Marines in the same PMOS, we analyze the number of months to promotion. Specifically, we measure the difference between ADSD and the date of rank for each grade. We sorted all enlisted Marines who have accessed since FY 1987 into cells that represented a new grade (E4, E5, or E6), fiscal year of the new grade (promotion), and PMOS.[37] We ranked Marines within a grade-PMOS-FY by the number of months between the ADSD and the promotion date and divided the cell into the following thirds (fast promoter, medium speed promoters, and slow promoters). This procedure gives each aviation or logistics Marine who was promoted to E4, E5, or E6 a promotion speed descriptor. We then grouped observations by occfield and compared the percentage of male and female Marines in each promotion speed category. As an example, Table 10 shows the speed of promotion for men and women in occfield 60, aircraft maintenance.

Table 10. Occfield 60, aircraft maintenance, promotions to E4, E5, and E6, by speed of promotion and gender (numbers are shown in parentheses)

	E4 promotions		E5 promotions		E6 promotions	
Promotion speed	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**
Fast promoters	36.8% (6,528)	42.2% (482)	35.7% (3,007)	40.1% (186)	35.7% (745)	38.6% (44)
Medium speed promoters	32.5% (5,766)	29.2% (334)	33.6% (2,827)	33.4% (155)	33.3% (693)	37.7% (43)
Slow promoters	30.7% (5,437)	28.6% (327)	30.7% (2,585)	26.5% (123)	31.0% (646)	23.7% (27)

Source: CNA calculations based on MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Sep. 2013.

In general, more than 33 percent of the observations are in the top third because we put ties (Marines with the same time to the grade) into the higher third. As Table 10 shows, women in occfield 60, aircraft maintenance, are more likely than men to be in the top third in promotion timing. For the PMOSs in occfield 60, 42.2 percent of women were in the top third for promotions to E4, 40.1 percent were in the top third for promotions to E5, and 38.6 percent were in the top third for promotions to E6.

Table 11 summarizes the top third for each occupational field in logistics or aviation. For the 04, logistics occfield, the male and female percentages in the top third in promotion timing are very similar for E4 and E5 promotions, although women are promoted faster to E4 and men are promoted faster to E5. For E6 promotions, however, the percentage of women in the top third (44.7 percent) is considerably higher than the percentage of men (35.7 percent).

[37] We dropped cells with fewer than five observations.

Table 11. Percentage of logistics and aviation enlisted Marines in top third of promotion speed, by occfield, gender, and grade

Occfield	E4 promotions		E5 promotions		E6 promotions	
	Men	Women	Men	Women	Men	Women
04, Logistics	36.7	37.8	37.1	37.0	36.5	44.7
Aviation occfields						
60, Aircraft maintenance	36.8	42.2	35.7	40.1	35.7	38.6
61, Aircraft maintenance (rotary)	38.4	47.2	37.5	51.5	39.5	41.2
62, Aircraft maintenance (fixed)	39.6	46.8	41.8	46.9	49.2	No women
63, Organizational avionics maintenance	37.3	41	37.7	37.4	38.5	44.6
64, Intermediate avionics maintenance	38.8	40.6	38.7	39.3	37.1	30.3
65, Aviation ordnance	36.9	40.1	36.3	36.8	36.9	38.8
66, Aviation logistics	37.7	36.6	37.8	31.1	35.5	41.3
68, METOC	37.6	41.0	38.9	39.3	41.2	33.3[a]
70, Airfield services	37.6	34.9	37.2	36.6	38.3	29.3
72, Air control	38.1	38.0	37.8	36.5	40.6	30.8
73, Enlisted flight crew	37.7	43.5	36.2	48.0	35.8	37.5[a]

Source: CNA calculations based on MCTFS, ARMS, and MCRISS snapshot data from Oct. 1986 through Sep. 2013.

[a] Fewer than 10 women were promoted over the entire period.

Women were promoted faster than men to E4 (indicated by a higher percentage in the top third in promotion timing) in 8 of the 11 aviation occfields, and faster to E5 and E6 in 7 of the 11 aviation occfields. Occfield 70, airfield services, and occfield 72, air control, are the two occfields in which women are slower to promote for all three grades, although the percentage differences between men and women in the top third in promotion timing are small for E4 and E5 promotions. Overall, however, women who are promoted to grades E4, E5, and E6 in aviation and logistics PMOSs are being promoted more quickly than are men in the same PMOSs.[38]

Summary

Our analysis shows that female enlisted Marines in aviation and logistics occupations are more likely to attrite during the first term than male enlisted Marines. The gap between male and female first-term attrition rates, however, is larger for the logistics occfield than for the aviation occfields, but the post-EAS attrition rate gender gap is larger for the aviation occfields.

[38] Complete tables are provided in Appendix F.

Although enlisted men in aviation and logistics PMOSs are somewhat more likely than enlisted women to be promoted to grades E4, E5, and E6, enlisted women are more likely to be promoted faster than enlisted men. Assuming that the most qualified Marines are promoted first, our findings suggest that female Marines in aviation and logistics PMOSs are generally of high quality.

Conclusions and Implications

The purpose of our analysis was to examine trends in female representation and performance in aviation and logistics occfields to provide insights into what may occur when the Marine Corps opens PMOSs that have been closed to women.

Female representation grew in both the aviation and logistics communities over the past 28 years. Women are relatively overrepresented in logistics occupations and underrepresented in aviation occupations. Since integration in 1993, female representation has continued to increase in the pilot/NFO occfield, but over the last 10 years, the rate at which it grew has slowed.

The lower female representation in the aviation community may partly be explained by the relationship between gender and PMOS requirements. We found that women are less likely than men to earn a 6 or better FAR on the ASTB, which is required for flying contracts. In addition, we find that women score lower than men on average on the technical sections of the ASVAB. This means that women are less likely to qualify for technical PEFs, such as the aviation PEFs, than men. The Marine Corps should keep the relationship between gender, screening tests, and the size of the recruitable pool in mind when making recruiting plans or considering changes to PMOS requirements. Ground combat occupations tend to have lower technical requirements, so these relationships between gender and screening tests may not be as important as the relationship between gender and PMOS school completion, promotions, or continuation rates.

The Marine Corps is conducting its own analysis of how men and women perform in ground combat occupation entry-level training, but our analysis of male and female flight training completion rates may also be useful in that flight training is a long process that is both physically and mentally challenging. We find that women are less likely to complete flight training than men, but women who had high FARs or were not in the bottom third of their TBS classes were more likely to complete flight training than women with lower FARs or in the bottom third of their TBS classes. This would suggest that increasing FAR requirements or adding TBS performance to the requirements needed to become a pilot would increase overall flight training completion rates. However, making it more difficult to enter the pilot/NFO pipeline may have adverse effects on female representation, since women generally have lower FARs than men. Since there are relatively few women entering these PMOSs, any reduction in the flow of female Marines into these occupations may have large

effects on representation. The Marine Corps should continue to monitor the numbers of women entering the training pipelines for these occupations and their performance in them in order to balance the demand and supply of Marines into these PMOSs.

Our analysis shows that women do not appear to have considerably lower promotion probabilities than their male peers. For officers, we did not find significant differences in promotion selection rates; for enlisted Marines, we find that women in aviation and logistics PMOSs were being promoted faster than their male peers. This suggests that women are successful in the aviation and logistics occupations.

Despite these promotion findings, we find that female officer retention rates are lower than those for male officers across all officer PMOSs and especially in the aviation PMOSs. This suggests that there is an aspect to serving in the military that affects women differently than men. It could be that being on active duty, particularly as a pilot or NFO, affects women's work-life balance more than men's. For example, pilots and NFOs need to fly to stay current, but a woman who is pregnant may not be able to fly and, therefore, may not be able to meet the minimum flying hours required to stay current. When making policies pertaining to women, the Marine Corps should consider these gender differences. If the Marine Corps wants to continue to increase its female representation and to encourage women to explore nontraditional military occupations, it will need to consider the barriers that women may face. We recommend that the Marine Corps consider conducting exit interviews or surveys with officers who are leaving the AC so that it can better understand the reasons that they choose to leave the Marine Corps and determine whether mitigating policies or practices are warranted.

Overall, our analysis indicates that the Marine Corps should continuously monitor gender-specific trends in recruiting and continuation behavior by PMOS. This would allow it to efficiently manage its manpower to minimize future gaps in the manpower paygrade pyramid. If the Marine Corps opens ground combat occupations, it may want to consider basing its manpower plans on data from open occupations that have similar requirements or tasks to the closed PMOSs in question.

Appendix A: Number of Enlisted Marines in the Logistics and Aviation Occfields

In this appendix, we show the number of enlisted women and the number of enlisted Marines in the logistics and aviation occupations.

Table 12 shows how female representation has changed over time for each aviation occfield. It also illustrates how representation varies across occfields. While female representation in both occfield 60 and occfield 61 tripled between FY 1987 and FY 2014, female representation was three times higher in occfield 60 than in occfield 61. In general, there does not appear to be any pattern between the size of an occfield and the percentage of women in the occfield. For example, two small occfields (68, METOC, and 73, enlisted flight crews) had considerably different percentages of enlisted women (12.2 and 2.4 percent, respectively) in FY 2014. Occfield 66, aviation logistics, had the largest percentage of women in FY 2014, at 18 percent, which is higher than occfield 70, airfield services, at 8.9 percent, which had a similar number of Marines in FY 2014.

Table 13 illustrates how female representation changed in the three largest entry-level logistics PMOSs over time. For 0411, maintenance management specialist, the percentage of women has been relatively constant: 14.2 percent in FY 1987 and 16.6 percent in FY 2014. The 0431 PMOS, logistics/embarkation specialist, shows a different pattern, growing sharply in the late 1990s and reaching 16.9 percent female by FY 2014. Relative to their overall representation in the Corps, women are substantially overrepresented in these two PMOSs. Finally, the 0481 PMOS, landing support specialist, did not admit women until FY 1995. Currently the PMOS is 6.2 percent female, just slightly under the representation of women in the enlisted Marine Corps.

Table 12. Number of Marines and percentage female, by aviation occfield, selected years from FY 1987 to FY 2014

	FY 1987		FY 1995		FY 2005		FY 2014	
Occfield	**No.**	**Pct.**	**No.**	**Pct.**	**No.**	**Pct.**	**No.**	**Pct.**
60, Aircraft maintenance	6,732	3.1	4,525	4.4	4,886	6.4	5,338	9.4
61, Aircraft maint. (rotary)	4,971	0.3	4,133	0.9	5,290	2.0	6,950	3.4
62, Aircraft maint. (fixed)	3,546	2.7	3,227	2.0	3,609	2.9	4,200	4.3
63, Organizational avionic maint.	5,251	3.0	3,286	3.1	4,019	6.8	4,806	7.5
64, Intermediate avionic maint.	3,398	4.5	2,488	4.8	2,798	7.1	3,171	7.0
65, Aviation ordnance	2,533	4.5	2,326	5.1	2,603	3.9	2,772	6.7
66, Aviation logistics[a]			1,740	13.4	1,928	17.1	2,063	18.7
68, METOC	260	5.8	295	9.5	339	6.5	465	14.6
70, Airfield services	2,316	5.5	2,171	6.9	2,291	8.6	2,436	8.9
72, Air control	1,070	1.8	1,496	6.3	1,536	7.0	1,696	8.1
73, Enlisted flight crew	861	6.0	217	2.8	294	2.4	241	5.4

Source: CNA tabulations of TFDW September snapshot data.

[a]. Marines were assigned to occfield 66 starting in FY 1993.

Table 13. Female representation in selected entry-level logistics PMOSs, selected years from FY 1987 to FY 2014

	0411, Maintenance management specialist		**0431, Logistics/embarkation specialist**		**0481, Landing support specialist**	
Fiscal year	No. of Marines	Pct. female	No. of Marines	Pct. female	No. of Marines	Pct. female
1987	888	14.2	948	7.9	942	0.0
1988	845	12.9	946	7.1	927	0.0
1989	823	13.0	902	6.9	868	0.0
1990	849	13.1	952	6.8	944	0.0
1991	912	12.7	1,033	6.0	971	0.0
1992	896	12.2	991	5.4	929	0.0
1993	858	13.8	956	5.4	888	0.0
1994	953	11.6	1,041	5.8	728	0.0
1995	960	11.7	1,050	6.6	830	0.8
1996	987	11.6	1,037	7.3	849	2.1
1997	937	14.3	997	9.7	819	2.0
1998	918	14.4	1,021	12.9	786	3.1

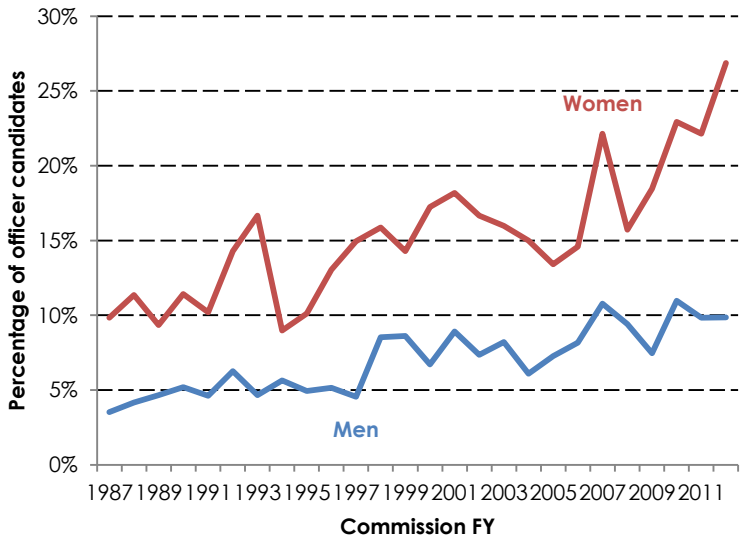
Fiscal year	0411, Maintenance management specialist		0431, Logistics/embarkation specialist		0481, Landing support specialist	
1999	869	16.6	1,015	15.1	743	3.8
2000	921	17.5	975	13.2	756	3.3
2001	971	16.8	1,003	10.4	764	2.9
2002	975	17.1	1,010	7.9	780	5.4
2003	984	18.0	1,075	7.7	757	5.0
2004	1,047	17.9	1,096	9.4	753	5.0
2005	1,030	15.9	1,102	11.0	721	4.7
2006	1,048	15.3	1,151	11.5	690	5.5
2007	1,115	16.4	1,166	11.1	731	6.4
2008	1,170	16.7	1,224	11.1	851	6.9
2009	1,186	17.8	1,280	12.1	938	6.6
2010	1,113	16.8	1,258	11.9	969	6.8
2011	1,065	16.3	1,240	13.5	973	7.2
2012	973	15.7	1,182	15.0	906	7.1
2013	974	16.3	1,166	15.0	956	6.7
2014	991	16.6	1,170	16.8	991	6.2

Source: CNA tabulations of MCTFS September snapshot data.

Appendix B: Officer Assignments

Using Marine Corps personnel data, we identified Marine officers whose first PMOS was in a logistics or aviation PMOS; this population includes officers commissioned between FY 1987 and FY 2012.[39] We group these officers into the following categories: logistics (PMOS 04XX), pilot/NFO (PMOS 75XX), and non-pilot/non-NFO (60XX, 66XX, or 72XX). Figure 26, Figure 27, and Figure 28 show, by gender, the percentage of a commission cohort assigned to PMOSs in the logistics occfield, non-pilot/non-NFO aviation occfields, and the pilot/NFO occfield, respectively, for FY 1987 to FY 2012.

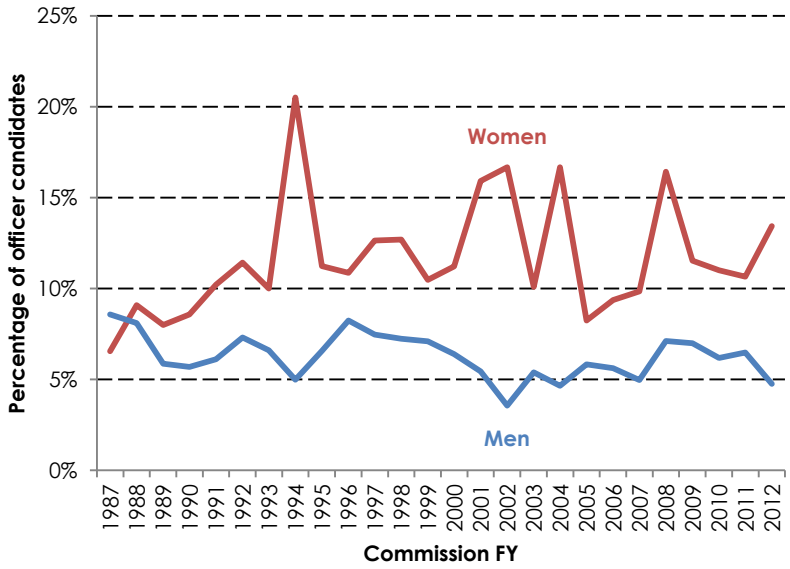
Figure 26. Percentage of officer candidates assigned to the logistics occfield, by gender, commission cohorts FY 1987 to FY 2012



Source: CNA tabulations from ARMS, MCRISS, and MCTFS end-of-month snapshot files from Oct. 1987 to Sep. 2012.

[39] We looked for officers whose first PMOS was observable and was not a general basic officer PMOS (e.g., PMOS 8001).

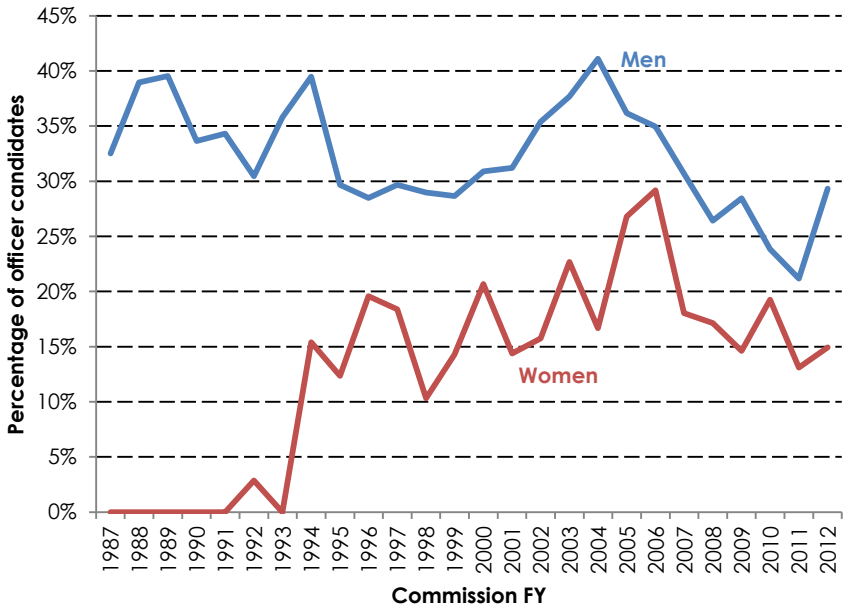
Figure 27. Percentage of officer candidates assigned to non-pilot/non-NFO aviation occfields, by gender, commission cohorts FY 1987 to FY 2012



Source: CNA tabulations from ARMS, MCRISS, and MCTFS end-of-month snapshot files from Oct. 1987 to Sep. 2012.

We find that female officers are more likely than male officers to enter logistics and non-pilot/non-NFO aviation occupations. In FY 2012, 27 percent of women entered logistics PMOSs and 13 percent entered non-pilot/non-NFO aviation PMOSs; 10 percent and 5 percent of men entered logistics and non-pilot/non-NFO aviation PMOSs, respectively. The opening of pilot/NFO PMOSs to women does not appear to have affected the number of female officers that entered logistics or non-pilot/non-NFO aviation PMOSs. However, we find that female officers were less likely to enter logistics occupations in FY 1999 (14.3 percent) than they were in 1993 (16.7 percent).

Figure 28. Percentage of officer candidates assigned to the pilot/NFO occfield, by gender, commission cohorts FY 1987 to FY 2012



Source: CNA tabulations from ARMS, MCRISS, and MCTFS end-of-month snapshot files from Oct. 1987 to Sep. 2012.

Over 14 percent of female officer candidates commissioned in FY 1994 went into pilot/NFO PMOSs. This percentage increased to 29 percent in FY 2006, which is not very different from the 32-percent average percentage of male officer candidates assigned to pilot/NFO PMOSs each fiscal year. In addition, the percentages of female officers who entered logistics and pilot/NFO PMOSs was larger than the percentage of female officers who entered personnel and administration (01XX) occupations (14 percent in FY 2005 and 11 percent in FY 2006), an occfield that has historically had high female representation.[40] There has been a decline in the percentage of female officers who entered pilot/NFO PMOSs among recent commissioning cohorts (only 15 percent of female officers entered pilot/NFO PMOSs in FY 2012). However, we find a similar decline in the percentage of male officers who entered these occupations after FY 2005 (the percentage of male officers fell from 36 percent in FY 2005 to 29 percent in FY 2012).

[40] On average, 39 percent of women entered the personnel and administration occfield each fiscal year.

Appendix C: Flight Training Regression Results

We present the full logistic regression results of flight training completion on observable Marine characteristics in Table 14. The table contains the results of a female-only model, a male-only model, and a pooled (male and female) model. We provide the point estimates as well as their associated estimated marginal effects (MEs). The ME is the change in the flight training completion rate associated with a one-unit change in the explanatory variable of interest. For example, the effect of being an NFO is estimated to be 8.8 percentage points for women and 5.8 percentage points for men. This means that a female NFO student is 8.8 percentage points more likely than a female student pilot to complete flight training, and a male NFO student is 5.8 percentage points more likely than a male student pilot to complete flight training.

To determine whether the coefficients estimated for men and women from the gender-specific models are statistically different, we also performed a single regression on the pooled population in which we interacted all of the explanatory variables with a female indicator variable. The results of estimating this model indicate that the estimates for women are not statistically different from those for men at standard confidence levels (e.g., 90- or 95-percent confidence intervals).

Table 14. Flight training completion regression results

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
FY of student PMOS									
FY94 to FY00	Omitted category				0.035	0.005	0.256	0.024	0.004
FY00 to FY05	0.334	-0.058	-0.011	0.226	0.195**	0.029	0.230	0.176**	0.026
FY05 to FY10	0.359	0.575	0.107	0.215	0.046	0.007	0.219	0.066	0.010
NFO	0.171	0.464	0.086	0.084	-0.300**	-0.045	0.087	-0.264**	-0.042
Lateral entry	0.035	0.633	0.118	0.026	0.205	0.031	0.027	0.221	0.032
FAR									
7	0.063	0.299	0.056	0.117	0.330**	0.049	0.115	0.334**	0.048
8		Drop[a]		0.118	0.573**	0.086	0.116	0.586**	0.078
No FAR	0.767	-0.473	-0.088	0.573	-0.040	-0.006	0.578	-0.050	-0.008
Female	1.000	n/a[b]		0.000	n/a		0.031	-0.415**	-0.069
Age	22.75	-0.058	-0.011	23.419	-0.103**	-0.015	23.401	-0.100**	-0.015
Hispanic	0.028	-1.053	-0.196	0.048	-0.158	-0.024	0.047	-0.173	-0.027
Race									
Black	0.031	-1.428**	-0.265	0.027	-0.398**	-0.060	0.027	-0.434**	-0.072
Other	0.111	-0.251	-0.047	0.073	-0.229**	-0.034	0.074	-0.219**	-0.035
Commission source									
NROTC	0.132	-0.379	-0.070	0.128	-0.147	-0.022	0.128	-0.147	-0.021
OCC	0.247	-0.210	-0.039	0.230	-0.248**	-0.037	0.232	-0.230**	-0.034
PLC	0.146	0.147	0.027	0.415	-0.209**	-0.031	0.407	-0.195**	-0.028
Enlisted	0.035	-0.342	-0.064	0.057	-0.306**	-0.046	0.056	-0.295**	-0.044
Other	0.045	-0.446	-0.083	0.025	-0.324*	-0.049	0.026	-0.306*	-0.046
No. of dependents									
One	0.052	0.952	0.177	0.128	0.160*	0.024	0.126	0.165**	0.024
Two or more	0.007	-1.185	-0.220	0.058	-0.002	0.000	0.057	-0.012	-0.002
1st Class PFT	0.951	0.258	0.048	0.967	0.303**	0.045	0.966	0.286**	0.046
GCT score	128.32	-0.009	-0.002	127.357	0.011**	0.002	127.396	0.011**	0.002
TBS third									
Middle	0.334	-0.111	-0.021	0.355	-0.317**	-0.048	0.354	-0.309**	-0.041
Bottom	0.404	-1.076**	-0.200	0.283	-0.962**	-0.144	0.286	-0.965**	-0.154
Constant		3.974			2.673**			2.660**	
No. of obs.		287			9,419			9,718	

Source: CNA estimates based on Oct. '86 to Mar. '14 MCTFS and MCRISS snapshot data.

** Indicates that the estimate is statistically different from 0 at the 5-percent level.

* Indicates that the estimate is statistically different from 0 at the 10-percent level.

a. All 12 female officers with FARs equal to 8 or 9 successfully completed flight training.

b. n/a stands for not applicable.

Appendix D: Officer Retention Regression Results

We present the full logistic regression results of officer 10-YCS retention on observable Marine characteristics in Table 15 and Table 16. Table 15 contains the results for logistics officers, and Table 16 contains the results for aviation officers. For each population, we estimated three different equations: a female-only equation, a male-only equation, and a pooled (male and female) equation.

We provide the point estimates as well as their associated estimated marginal effects (MEs). The ME is the change in the retention rate associated with a one-unit change in the explanatory variable of interest. For example, Table 15 shows that the effect of being a lateral move out of a PMOS is estimated to be 32.3 percentage points for women and 53.6 percentage points for men. This means that a woman who laterally moved is 32.3 percentage points more likely than a woman who did not laterally move to reach 10 YCS, and a man who laterally moved is 53.6 percentage points more likely than a man who did not laterally move to reach 10 YCS.

To determine if the coefficients estimated for men and women from the gender-specific models are statistically different, we also performed a single regression on the pooled population in which we interacted all of the explanatory variables with a female indicator variable. We indicate that the coefficients from the male and female models are statistically different at the 5-percent level by highlighting them in gray in the tables that follow.

Table 15. Logistics officer retention to 10 YCS regression results

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
Female	1.000	n/a[a]	n/a	0.000	n/a	n/a	0.132	-0.163	-0.032
Lateral exit	0.025	1.681*	0.323	0.028	2.749**	0.536	0.028	2.448**	0.452
GCT score	124.30	-0.028	-0.005	123.93	-0.017**	-0.003	123.97	-0.017**	-0.003
1st Class PFT	0.802	-0.578	-0.111	0.788	0.457**	0.089	0.790	0.329**	0.064
TBS third									
Middle	0.292	-0.570	-0.110	0.341	-0.001	0.000	0.335	-0.092	-0.019
Bottom	0.495	-0.220	-0.042	0.398	-0.343*	-0.067	0.411	-0.334**	-0.067
Commission source									
NROTC	0.287	0.164	0.031	0.187	-0.132	-0.026	0.200	-0.094	-0.020
OCC	0.337	-0.384	-0.074	0.265	-0.417*	-0.081	0.275	-0.383*	-0.079
PLC	0.104	-0.065	-0.012	0.262	-0.392*	-0.077	0.241	-0.334	-0.069
Enlisted	0.040	1.198	0.230	0.148	0.562*	0.110	0.134	0.615**	0.133
Other	0.045	0.997	0.192	0.034	0.327	0.064	0.035	0.357	0.077
Married	0.173	0.169	0.033	0.267	1.347**	0.263	0.255	0.860**	0.185
No. of dependents									
One	0.045	1.354	0.260	0.139	-0.676	-0.132	0.126	-0.200	-0.039
Two or more	0.035	-1.328	-0.255	0.129	-0.408	-0.080	0.117	-0.054	-0.011
Age	23.13	0.222**	0.043	24.010	0.146**	0.029	23.89	0.148**	0.029
Hispanic	0.074	0.987	0.190	0.071	-0.831**	-0.162	0.072	-0.539**	-0.101
Race									
Black	0.050	-1.715	-0.330	0.080	0.141	0.027	0.076	0.014	0.003
Other	0.124	-0.391	-0.075	0.090	0.547**	0.107	0.094	0.428**	0.087
Commission FY									
FY94-FY00	0.371	0.033	0.006	0.332	0.531**	0.104	0.337	0.455**	0.090
FY01-FY04	0.446	0.038	0.007	0.322	0.434**	0.085	0.339	0.400**	0.079
Constant		-1.582			-2.367**			-2.251*	
No. of obs.		202			1,334			1,536	

Source: CNA estimates based on Oct. '86 to Mar. '14 MCTFS and MCRISS snapshot data.

** Indicates that the estimate is statistically different from zero at the 5-percent level

* Indicates that the estimate is statistically different from zero at the 10-percent level.

[a] n/a stands for not applicable.

Table 16. Aviation officer retention to 10 YCS regression results

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
Female	1.00	n/a[a]		0.000	n/a		0.042	-0.979**	-0.198
Platform/ occfield									
F/A-18		n/a		0.094	0.078	0.014	0.066	0.064	0.010
F/A-18 NFO		Omitted category		0.033	-0.298	-0.055	0.090	-0.375	-0.063
V-22		n/a		0.003	0.416	0.077	0.033	0.065	0.010
EA-6B		n/a		0.015	0.056	0.010	0.003	0.075	0.011
EA-6B NFO	0.037	-2.299**	-0.391	0.035	-1.194**	-0.221	0.014	-1.292**	-0.250
KC-130	0.019	1.558	0.265	0.061	-0.654**	-0.121	0.035	-0.650**	-0.115
CH-53	0.078	1.243	0.212	0.119	-0.341**	-0.063	0.060	-0.345**	-0.057
CH-46	0.104	0.541	0.092	0.169	-0.342**	-0.063	0.117	-0.358**	-0.060
UH-1	0.030	1.477	0.251	0.065	-0.618**	-0.114	0.166	-0.616**	-0.108
AH-1	0.037	0.117	0.020	0.091	-0.254*	-0.047*	0.064	-0.282*	-0.046*
60XX	0.149	-0.964	-0.164	0.059	-1.514**	-0.281	0.089	-1.520**	-0.300
66XX	0.127	-0.670	-0.114	0.041	-1.582**	-0.293	0.044	-1.537**	-0.304
72XX	0.366	-1.481**	-0.252	0.147	-1.673**	-0.310	0.155	-1.707**	-0.341
FAR									
7	0.034	0.433	0.074	0.105	-0.076	-0.014	0.102	-0.058	-0.010
8	0.030	0.336	0.057	0.121	-0.009	-0.002	0.117	0.000	0.000
No FAR	0.836	0.187	0.032	0.614	-0.284**	-0.053	0.623	-0.261**	-0.048
Lateral out	0.138	2.245**	0.382	0.154	1.021**	0.189	0.153	1.047**	0.174
GCT score	126.6	-0.026	-0.004	127.5	-0.002**	0.000	127.4	-0.003	0.000
1st Class PFT	0.799	0.181	0.031	0.878	0.278**	0.052	0.875	0.269**	0.051
TBS third									
Middle	0.306	0.082	0.014	0.356	-0.208**	-0.039	0.354	-0.204**	-0.038
Bottom	0.485	0.073	0.012	0.285	-0.457**	-0.085	0.294	-0.441**	-0.084
Commission source									
NROTC	0.257	-0.365	-0.062	0.149	0.090	0.017	0.154	0.072	0.013
OCC	0.343	-1.038**	-0.177	0.236	-0.369**	-0.068	0.240	-0.372**	-0.070
PLC	0.090	-1.014	-0.173	0.385	-0.271**	-0.050	0.372	-0.280**	-0.052
Enlisted	0.056	0.416	0.071	0.082	0.643**	0.119	0.081	0.666**	0.107
Other	0.030	-0.955	-0.162	0.024	0.070	0.013	0.025	0.020	0.004
Married	0.138	1.142	0.194	0.216	-0.152	-0.028	0.213	-0.005	-0.001
No. of dependents									
One	0.078	0.839	0.143	0.147	0.463	0.086	0.144	0.359	0.066
Two or more	0.011	-2.327	-0.396	0.076	0.894**	0.166	0.073	0.722**	0.125
Age	23.28	0.111	0.019	23.64	0.059**	0.011	23.62	0.063**	0.012
Hispanic	0.034	-1.195	-0.203	0.049	0.017	0.003	0.048	-0.016	-0.003

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
Race									
Black	0.067	0.619	0.105	0.039	0.055	0.010	0.040	0.105	0.019
Other	0.082	0.269	0.046	0.067	0.143	0.026	0.067	0.138	0.025
Commission FY									
FY94-FY00	0.410	-0.472	-0.080	0.279	0.676**	0.125	0.284	0.664**	0.127
FY01-FY04	0.459	-0.344	-0.059	0.262	0.818**	0.152	0.271	0.794**	0.149
Constant		0.688			-0.011			-0.025	
No. of obs.		256			6,222			6,497	

Source: CNA estimates based on Oct. '86 to Mar. '14 MCTFS and MCRISS snapshot data.

** Indicates that the estimate is statistically different from zero at the 5-percent level

* Indicates that the estimate is statistically different from zero at the 10-percent level.

[a.] n/a stands for not applicable.

Appendix E: Enlisted Attrition Regression Results

Table 17 presents the following three regressions for Marines in aviation PMOSs who reached at least 16 months:

- 44-month attrition rate regressions for female Marines
- 44-month attrition rate regressions for male Marines
- 44-month attrition rate regressions for both male and female Marines

Table 18 is a similar table for the logistics PMOS, while Table 19 and Table 20 present the regression results analyzing 75-month attrition rates for aviation and logistics PMOSs, respectively.

To determine whether the coefficient estimates for men and women are statistically different, we performed a single regression for men and women in which all regressors were entered both independently and interacted with the female variable. We have indicated which estimates are statistically different for men and women at the 5-percent level by shading the background for these variables. For example, in Table 17, the coefficients and the ME for men and women in FY 1987 through FY 1990 are statistically significant different from each other. In general, the regressions in Table 17 through Table 20 show very few coefficients and derivatives that are statistically different for men and women.

Table 17. 44-month attrition for aviation PMOSs: Logistic regression for FY 1987 to FY 2010 accessions

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
Accession FY									
FY 1987	0.025	0.690**	0.100	0.039	-0.533**	-0.053	0.038	-0.405**	-0.042
FY 1988	0.035	0.481	0.065	0.042	-0.512**	-0.051	0.042	-0.408**	-0.042
FY 1989	0.030	0.724**	0.106	0.044	-0.552**	-0.055	0.043	-0.427**	-0.043
FY 1990	0.019	0.853**	0.129	0.032	-0.314**	-0.034	0.031	-0.211*	-0.023
FY 1991	0.021	0.44	0.059	0.030	-0.259**	-0.028	0.030	-0.183*	-0.020
FY 1992	0.032	0.898**	0.137	0.036	-0.456**	-0.047	0.036	-0.306**	-0.032
FY 1993	0.026	0.674**	0.097	0.040	-0.595**	-0.058	0.039	-0.466**	-0.047
FY 1994	0.031	0.205	0.026	0.038	-0.540**	-0.054	0.038	-0.449**	-0.045
FY 1995	0.039	0.098	0.012	0.038	-0.421**	-0.044	0.038	-0.352**	-0.037
FY 1996	0.043	-0.424	-0.043	0.043	-0.489**	-0.050	0.043	-0.458**	-0.046
FY 1997	0.050	-0.231	-0.025	0.050	-0.436**	-0.045	0.050	-0.399**	-0.041
FY 1998	0.067	0.111	0.014	0.049	-0.433**	-0.045	0.050	-0.380**	-0.039
FY 1999	0.050	0.026	0.003	0.053	-0.277**	-0.030	0.053	-0.235*	-0.026
FY 2000	0.052	-0.022	-0.003	0.046	-0.329**	-0.035	0.046	-0.292**	-0.031
FY 2001	0.046	-0.271	-0.029	0.048	-0.506**	-0.051	0.048	-0.471**	-0.047
FY 2002	0.047	-0.076	-0.009	0.043	-0.619**	-0.060	0.043	-0.562**	-0.055
FY 2003	0.046	-0.02	-0.002	0.044	-0.651**	-0.062	0.045	-0.579**	-0.056
FY 2004	0.042	-0.428	-0.043	0.043	-0.569**	-0.056	0.043	-0.542**	-0.053
FY 2005	0.057	-0.366	-0.038	0.044	-0.654**	-0.063	0.045	-0.630**	-0.060
FY 2006	0.061	-0.34	-0.035	0.041	-0.780**	-0.072	0.043	-0.737**	-0.067
FY 2007	0.053	-0.997**	-0.083	0.044	-0.555**	-0.055	0.045	-0.586**	-0.056
FY 2008	0.053	-0.311	-0.033	0.051	-0.289**	-0.031	0.051	-0.281**	-0.030
FY 2009	0.055	0.281	0.036	0.044	0.022	0.003	0.045	0.044	0.005
Occfield									
61XX	0.054	0.312*	0.037	0.140	0.121**	0.011	0.135	0.126**	0.011
62XX	0.037	0.348	0.042	0.069	0.185**	0.017	0.067	0.211**	0.020
63XX	0.151	0.184	0.021	0.138	-0.059	-0.005	0.139	-0.04	-0.003
64XX	0.094	0.054	0.006	0.088	-0.283**	-0.021	0.089	-0.236**	-0.019
65XX	0.114	0.323**	0.039	0.098	-0.054	-0.004	0.099	-0.001	0.000
66XX	0.148	0.022	0.002	0.047	0.065	0.006	0.053	0.032	0.003
68XX	0.016	0.148	0.017	0.009	0.086	0.008	0.010	0.112	0.010
70XX	0.113	0.214	0.025	0.084	0.113**	0.010	0.086	0.137**	0.012
72XX	0.049	0.360*	0.044	0.071	0.328**	0.031	0.069	0.340**	0.033
73XX	0.016	0.2	0.023	0.013	-0.021	-0.002	0.013	0.037	0.003
Hispanic	0.092	-0.438**	-0.047	0.081	-0.280**	-0.022	0.082	-0.290**	-0.024
Race									
Black	0.138	-0.372**	-0.042	0.091	0.316**	0.030	0.094	0.247**	0.024
Other	0.107	-0.529**	-0.057	0.078	-0.189**	-0.015	0.080	-0.227**	-0.018
High-quality	0.848	-0.246**	-0.031	0.816	-0.164**	-0.015	0.818	-0.159**	-0.015
5-year obligation	0.408	0.133	0.016	0.533	-0.093**	-0.008	0.525	-0.053*	-0.005
1st Class PFT	0.422	-1.151**	-0.124	0.363	-1.144**	-0.084	0.367	-1.143**	-0.087

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
3 months or more in DEP	0.630	-0.230**	-0.028	0.683	-0.336**	-0.030	0.680	-0.326**	-0.030
Age	19.21	0.01	0.01	19.18	-0.01	-0.01	19.18	-0.01	
Female							0.066	0.570**	
Constant		-1.270**			-0.973**			-1.161**	
Observations		6,243			8,8932			9,5175	

Source: CNA estimates based on Oct. '86 to Mar. '14 MCTFS and MCRISS snapshot data.

** Indicates that the estimate is statistically different from 0 at the 5-percent level.

* Indicates that the estimate is statistically different from 0 at the 10-percent level.

Table 18. 44-month attrition for logistics PMOSs: Logistic regression for FY 1987 to FY 2010 accessions

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
Accession FY									
FY 1987	0.032	0.64	0.113	0.049	0.806**	0.086	0.047	0.724**	0.084
FY 1988	0.014	-0.587	-0.077	0.030	0.315	0.028	0.029	0.189	0.018
FY 1989	0.022	1.303*	0.254	0.041	0.711*	0.073	0.039	0.691**	0.079
FY 1990	0.028	0.254	0.042	0.048	0.689*	0.070	0.046	0.591*	0.065
FY 1991	0.016	0.257	0.042	0.042	0.960**	0.108	0.040	0.845**	0.102
FY 1992	0.028	0.959	0.179	0.032	0.784**	0.083	0.032	0.765**	0.090
FY 1993	0.031	0.974	0.182	0.058	0.626*	0.062	0.055	0.588*	0.065
FY 1994	0.033	-0.601	-0.079	0.039	0.786**	0.083	0.039	0.593*	0.066
FY 1995	0.029	0.399	0.067	0.046	0.656*	0.066	0.044	0.567*	0.062
FY 1996	0.063	-0.262	-0.038	0.039	0.557	0.054	0.041	0.401	0.041
FY 1997	0.060	-0.077	-0.012	0.038	0.616	0.061	0.040	0.479	0.051
FY 1998	0.058	-0.969	-0.113	0.038	0.579	0.057	0.040	0.34	0.034
FY 1999	0.061	-0.023	-0.003	0.040	0.484	0.046	0.042	0.383	0.039
FY 2000	0.029	0.494	0.085	0.046	0.34	0.030	0.045	0.316	0.032
FY 2001	0.040	0.34	0.057	0.045	0.451	0.042	0.044	0.394	0.040
FY 2002	0.059	-0.156	-0.023	0.044	0.469	0.044	0.046	0.326	0.033
FY 2003	0.049	-0.01	-0.002	0.043	0.08	0.006	0.044	0.036	0.003
FY 2004	0.050	-0.512	-0.069	0.042	0.386	0.035	0.042	0.223	0.021
FY 2005	0.046	-0.618	-0.080	0.045	0.265	0.023	0.045	0.105	0.010
FY 2006	0.056	-0.928	-0.110	0.043	0.137	0.011	0.044	-0.061	-0.005
FY 2007	0.065	-1.00	-0.116	0.046	0.357	0.032	0.048	0.12	0.011
FY 2008	0.067	-0.635	-0.082	0.056	0.610*	0.060	0.057	0.406	0.042
FY 2009	0.054	0.044	0.007	0.039	0.687*	0.070	0.041	0.558**	0.061
Hispanic	0.127	-0.578**	-0.072	0.111	-0.465**	-0.048	0.113	-0.452**	-0.048
Race									
Black	0.118	-0.624**	-0.076	0.123	0.314**	0.040	0.123	0.228**	0.029
Other race	0.108	0.167	0.025	0.094	0.044	0.005	0.095	0.031	0.004

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
High-quality	0.852	0.094	0.013	0.690	-0.157**	-0.019	0.706	-0.132**	-0.016
5-year obligation	0.018	0.473	0.072	0.019	0.371**	0.049	0.019	0.377**	0.051
1st Class PFT	0.372	-1.362**	-0.170	0.321	-1.118**	-0.110	0.326	-1.147**	-0.116
3 months or more in DEP	0.632	-0.235	-0.033	0.632	-0.300**	-0.036	0.632	-0.292**	-0.036
Age	18.99	0.054	0.008	19.13	-0.023	-0.003	19.12	-0.01	-0.001
Female							0.099	0.562**	0.078
Constant		-1.823**			-1.372**			-1.519**	
Observations		1232			11193			12425	

Source: CNA estimates based on Oct. '86 to Mar. '14 MCTFS and MCRISS snapshot data.

** Indicates that the estimate is statistically different from 0 at the 5-percent level.

* Indicates that the estimate is statistically different from 0 at the10-percent level.

Table 19. 75-month attrition for aviation PMOSs: Logistic regression for FY 1987 to FY 2007 accessions

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
Accession FY									
FY 1987	0.029	-0.339	-0.061	0.045	-0.252**	-0.044	0.044	-0.242**	-0.042
FY 1988	0.041	-0.178	-0.031	0.049	-0.112*	-0.019	0.048	-0.106*	-0.018
FY 1989	0.035	-0.252	-0.045	0.051	-0.137**	-0.023	0.050	-0.132*	-0.023
FY 1990	0.022	-0.202	-0.035	0.037	-0.208**	-0.036	0.036	-0.201**	-0.035
FY 1991	0.025	-0.796**	-0.153	0.035	-0.346**	-0.062	0.034	-0.360**	-0.064
FY 1992	0.038	-0.461*	-0.085	0.041	-0.409**	-0.074	0.041	-0.402**	-0.073
FY 1993	0.031	-0.377	-0.068	0.046	-0.360**	-0.064	0.045	-0.350**	-0.063
FY 1994	0.036	-0.141	-0.024	0.044	-0.357**	-0.063	0.044	-0.336**	-0.060
FY 1995	0.046	-0.021	-0.003	0.043	-0.259**	-0.045	0.043	-0.236**	-0.041
FY 1996	0.050	-0.05	-0.008	0.049	-0.419**	-0.075	0.049	-0.392**	-0.070
FY 1997	0.059	-0.09	-0.015	0.057	-0.292**	-0.051	0.057	-0.273**	-0.048
FY 1998	0.078	0.129	0.021	0.057	0.065	0.011	0.058	0.068	0.011
FY 1999	0.058	0.420*	0.064	0.061	0.287**	0.044	0.061	0.297**	0.046
FY 2000	0.061	0.365*	0.057	0.052	0.320**	0.049	0.053	0.322**	0.050
FY 2001	0.054	0.294	0.046	0.055	0.281**	0.044	0.055	0.285**	0.044
FY 2002	0.056	0.119	0.020	0.049	-0.09	-0.015	0.050	-0.071	-0.012
FY 2003	0.054	-0.059	-0.010	0.051	-0.226**	-0.039	0.051	-0.211**	-0.037
FY 2004	0.049	-0.204	-0.036	0.050	-0.409**	-0.073	0.050	-0.391**	-0.070
FY 2005	0.067	-0.037	-0.006	0.051	-0.199**	-0.034	0.052	-0.188**	-0.033
FY 2006	0.072	0.166	0.027	0.048	-0.07	-0.012	0.049	-0.048	-0.008
Occfield									
61XX	0.044	0.192	0.032	0.136	0.070**	0.013	0.130	0.075**	0.013
62XX	0.029	0.427*	0.068	0.055	0.069	0.012	0.053	0.078*	0.014

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
63XX	0.149	-0.127	-0.023	0.140	-0.007	-0.001	0.141	-0.006	-0.001
64XX	0.095	-0.214	-0.039	0.088	0.05	0.009	0.088	0.039	0.007
65XX	0.122	0.386**	0.062	0.099	0.155**	0.027	0.100	0.174**	0.030
66XX	0.148	-0.129	-0.023	0.043	-0.014	-0.003	0.050	-0.044	-0.008
68XX	0.017	0.11	0.019	0.010	-0.285**	-0.054	0.010	-0.245**	-0.046
70XX	0.116	0.167	0.028	0.086	0.289**	0.049	0.088	0.277**	0.047
72XX	0.051	0.099	0.017	0.072	0.275**	0.047	0.070	0.276**	0.047
73XX	0.019	0.085	0.015	0.013	-0.134*	-0.025	0.014	-0.118*	-0.022
Hispanic	0.099	-0.034	-0.006	0.086	-0.247**	-0.045	0.087	-0.231**	-0.042
Race									
Black	0.137	-0.371**	-0.066	0.091	-0.380**	-0.071	0.094	-0.381**	-0.071
Other race	0.112	-0.422**	-0.076	0.082	0.088**	0.015	0.084	0.045	0.008
High-quality	0.859	0.151	0.026	0.820	0.001	0.000	0.823	0.011	0.002
5-year contract	0.389	0.316**	0.053	0.511	0.035	0.006	0.503	0.048*	0.009
1st Class PFT	0.391	-1.377**	-0.255	0.321	-1.364**	-0.273	0.326	-1.361**	-0.272
3 or more months in DEP	0.641	-0.06	-0.010	0.686	-0.064**	-0.011	0.683	-0.063**	-0.011
Age	19.20	0.011	0.002	19.13	-0.029**	-0.005	19.14	-0.026**	-0.005
Female							0.064	0.182**	0.031
Constant		1.413**			2.273**			2.189**	
Observations		5,325			77,503			82,828	

Source: CNA estimates from MCTFS and MCRISS snapshot files for Oct. 1986 to Mar. 2014.

** Indicates that the estimate is statistically different from 0 at the 5-percent level.

* Indicates that the estimate is statistically different from 0 at the 10-percent level.

Table 20. 75-month attrition for logistics PMOSs: Logistic regression for FY 1987 to FY 2007 accessions

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
Accession FY									
FY 1987	0.038	-1.573**	-0.218	0.056	-0.456**	-0.075	0.054	-0.552**	-0.089
FY 1988	0.016	-2.329**	-0.367	0.035	-0.562**	-0.094	0.033	-0.688**	-0.114
FY 1989	0.026	-0.938	-0.112	0.047	-0.037	-0.006	0.045	-0.119	-0.017
FY 1990	0.033	-1.535**	-0.211	0.055	-0.004	-0.001	0.053	-0.121	-0.018
FY 1991	0.019	-1.148	-0.144	0.048	-0.348*	-0.056	0.045	-0.427*	-0.067
FY 1992	0.033	-1.298*	-0.169	0.037	-0.255	-0.040	0.037	-0.351*	-0.054
FY 1993	0.037	-1.294**	-0.168	0.066	-0.221	-0.034	0.063	-0.314*	-0.048
FY 1994	0.040	-1.710**	-0.243	0.045	-0.252	-0.040	0.045	-0.388**	-0.060
FY 1995	0.035	-0.861	-0.101	0.053	-0.197	-0.031	0.051	-0.272	-0.041
FY 1996	0.074	-1.112**	-0.139	0.044	-0.453**	-0.074	0.047	-0.503**	-0.080

Explanatory variable	Women			Men			All		
	Mean	Coeff.	ME	Mean	Coeff.	ME	Mean	Coeff.	ME
FY 1997	0.072	-0.838	-0.097	0.043	-0.137	-0.021	0.046	-0.211	-0.032
FY 1998	0.069	-1.297**	-0.169	0.043	-0.278	-0.044	0.046	-0.392**	-0.061
FY 1999	0.073	-0.978*	-0.118	0.046	0.23	0.032	0.048	0.094	0.013
FY 2000	0.035	0.507	0.039	0.053	0.343*	0.047	0.051	0.310*	0.041
FY 2001	0.047	0.046	0.004	0.052	0.508**	0.066	0.051	0.453**	0.057
FY 2002	0.071	-0.401	-0.041	0.051	0.235	0.033	0.053	0.164	0.022
FY 2003	0.058	-1.073**	-0.132	0.049	-0.1	-0.015	0.050	-0.204	-0.030
FY 2004	0.060	-1.596**	-0.222	0.048	-0.546**	-0.091	0.049	-0.653**	-0.107
FY 2005	0.055	-1.070*	-0.132	0.051	-0.466**	-0.076	0.052	-0.533**	-0.085
FY 2006	0.067	-0.87	-0.102	0.049	-0.357**	-0.057	0.051	-0.412**	-0.064
Hispanic	0.138	-0.676**	-0.111	0.118	-0.226**	-0.037	0.120	-0.262**	-0.043
Race									
Black	0.123	-0.630**	-0.104	0.126	-0.370**	-0.062	0.126	-0.391**	-0.066
Other race	0.119	-0.113	-0.017	0.101	-0.047	-0.007	0.103	-0.055	-0.009
High-quality	0.859	0.597**	0.098	0.693	-0.024	-0.004	0.709	0.004	0.001
5-year obligation	0.015	-0.579	-0.097	0.018	-0.193	-0.032	0.018	-0.225	-0.037
1st Class PFT	0.353	-1.759**	-0.306	0.284	-1.623**	-0.313	0.290	-1.628**	-0.312
3 or more months in DEP	0.640	0.108	0.016	0.636	-0.025	-0.004	0.637	-0.004	-0.001
Age	19.04	0.058	0.009	19.11	-0.029**	-0.005	19.11	-0.019	-0.003
Female							0.096	0.155*	0.024
Constant		1.525			2.602**			2.470**	
Observations		1,034			9,760			10,794	

Source: CNA estimates based on Oct. '86 to Mar. '14 MCTFS and MCRISS snapshot data.

** Indicates that the estimate is statistically different from 0 at the 5-percent level.

* Indicates that the estimate is statistically different from 0 at the 10-percent level.

Appendix F: Speed of Enlisted Promotions

As explained in the main text, we analyzed promotions by PMOS and year of promotion for grades E4, E5, and E6. For each Marine in a cell (for example, E4 promotions in PMOS 0411 in FY90), we determined the number of months between the ADSD and the promotion date. We divided the Marines in the cell into thirds by the number of months to the promotion: top third (fastest promotes), middle third, and bottom third (slowest promotes). We then aggregated the results for the occfield and determined the percentage of men and the percentage of women in each third. The results from this exercise are shown in Table 21 by occfield.

Table 21. Speed of promotion to E4 through E6, by logistics and aviation occfield and gender

Promotion speed	E4 promotion		E5 promotion		E6 promotion	
	Men	Women	Men	Women	Men	Women
Occfield 04						
Top third Percentage (number)	36.7% (3,300)	37.8% (385)	37.1% (1,233)	37.0% (129)	36.5% (397)	44.7% (51)
Middle third Percentage (number)	32.9% (2,960)	31.4% (320)	32.2% (1,069)	33.5% (117)	34.5% (375)	27.2% (31)
Bottom third Percentage (number)	30.3% (2,725)	30.7% (313)	30.7% (1,021)	29.5% (103)	29.0% (316)	28.1% (32)
Occfield 60						
Top third Percentage (number)	36.8% (6,528)	42.2% (482)	35.7% (3,007)	40.1% (186)	35.7% (745)	38.6% (44)
Middle third Percentage (number)	32.5% (5,766)	29.2% (334)	33.6% (2,827)	33.4% (155)	33.3% (693)	37.7% (43)
Bottom third Percentage (number)	30.7% (5,437)	28.6% (327)	30.7% (2,585)	26.5% (123)	31.0% (646)	23.7% (27)
Occfield 61						
Top third Percentage (number)	38.4% (3,974)	47.2% (135)	37.5% (2,119)	51.5% (67)	39.5% (550)	41.2% (7)

Promotion speed	E4 promotion		E5 promotion		E6 promotion	
	Men	Women	Men	Women	Men	Women
Middle third Percentage (number)	32.7% (3,381)	27.6% (79)	33.4% (1,890)	27.7% (36)	32.9% (459)	29.4% (5)
Bottom third Percentage (number)	28.9% (2,993)	25.2% (72)	29.1% (1,645)	20.8% (27)	27.6% (385)	29.4% (5)
Occfield 62						
Top third Percentage (number)	39.6% (2,156)	46.8% (101)	41.8% (1,169)	46.9% (46)	49.2% (124)	0.0% (0)
Middle third Percentage (number)	32.1% (1,750)	32.4% (70)	32.6% (913)	31.6% (31)	31.7% (80)	50.0% (1)
Bottom third Percentage (number)	28.3% (1,542)	20.8% (45)	25.6% (715)	21.4% (21)	19.0% (48)	50.0% (1)
Occfield 63						
Top third Percentage (number)	37.3% (3,588)	41.0% (294)	37.7% (1,954)	37.4% (133)	38.5% (432)	44.6% (25)
Middle third Percentage (number)	32.9% (3,161)	32.4% (232)	33.0% (1,711)	31.7% (113)	33.7% (379)	28.6% (16)
Bottom third Percentage (number)	29.8% (2,870)	26.6% (191)	29.3% (1,518)	30.9% (110)	27.8% (312)	26.8% (15)
Occfield 64						
Top third Percentage (number)	38.8% (2,266)	40.6% (168)	38.7% (1,129)	39.3% (88)	37.1% (167)	30.3% (10)
Middle third Percentage (number)	33.0% (1,928)	28.3% (117)	33.4% (975)	31.3% (70)	32.2% (145)	42.4% (14)
Bottom third Percent (number)	28.2% (1,650)	31.2% (129)	27.9% (816)	29.5% (66)	30.7% (138)	27.3% (9)
Occfield 65						
Top third Percentage (number)	36.9% (2,720)	40.1% (230)	36.3% (1,013)	36.8% (70)	36.9% (296)	38.8% (19)
Middle third Percentage (number)	32.6% (2,404)	30.0% (172)	32.4% (904)	39.5% (75)	32.3% (259)	30.6% (15)
Bottom third Percentage (number)	30.5% (2,251)	30.0% (172)	31.3% (872)	23.7% (45)	30.8% (247)	30.6% (15)
Occfield 66						
Top third Percentage (number)	37.7% (1,301)	36.6% (297)	37.8% (492)	31.1% (98)	35.5% (128)	41.3% (38)

Promotion speed	E4 promotion		E5 promotion		E6 promotion	
	Men	Women	Men	Women	Men	Women
Middle third Percentage (number)	32.2% (1,111)	31.3% (254)	32.5% (423)	34.0% (107)	34.1% (123)	29.3% (27)
Bottom third Percentage (number)	30.1% (1,040)	32.1% (260)	29.6% (385)	34.9% (110)	30.5% (110)	29.3% (27)
Occfield 68						
Top third Percentage (number)	37.6% (253)	41.0% (32)	38.9% (119)	39.3% (11)	41.2% (47)	33.3% (3)
Middle third Percentage (number)	32.7% (220)	33.3% (26)	35.3% (108)	32.1% (9)	31.6% (36)	22.2% (2)
Bottom third Percentage (number)	29.7% (200)	25.6% (20)	25.8% (79)	28.6% (8)	27.2% (31)	44.4% (4)
Occfield 70						
Top third Percentage (number)	37.6% (2,257)	34.9% (200)	37.2% (825)	36.6% (78)	38.3% (242)	29.3% (17)
Middle third Percentage (number)	31.6% (1,895)	35.1% (201)	32.0% (710)	29.1% (62)	32.6% (206)	31.0% (18)
Bottom third Percentage (number)	30.8% (1,851)	30.0% (172)	30.8% (684)	34.3% (73)	29.1% (184)	39.7% (23)
Occfield 72						
Top third Percentage (number)	38.1% (1,847)	38.0% (92)	37.8% (867)	36.5% (42)	40.6% (218)	30.8% (8)
Middle third Percentage (number)	32.4% (1,573)	35.5% (86)	32.4% (743)	29.6% (34)	32.2% (173)	42.3% (11)
Bottom third Percentage (number)	29.5% (1,429)	26.4% (64)	29.8% (683)	33.9% (39)	27.2% (146)	26.9% (7)
Occfield 73						
Top third Percentage (number)	37.7% (248)	43.5% (27)	36.2% (113)	48.0% (12)	35.8% (38)	37.5% (3)
Middle third Percentage (number)	32.7% (215)	32.3% (20)	31.4% (98)	32.0% (8)	34.0% (36)	50.0% (4)
Bottom third Percentage (number)	29.6% (195)	24.2% (15)	32.4% (101)	20.0% (5)	30.2% (32)	12.5% (1)

Source: CNA calculations of MCTFS and MCRISS snapshot data from Oct. 1986 through Mar. 2014.

References

[1] Dempsey, GEN Martin, Chairman of the Joint Chiefs of Staff, and Secretary of Defense Leon Panetta. Jan. 24, 2013. Memorandum for Secretaries of the Military Departments Acting Under Secretary of Defense for Personnel and Readiness and Chiefs of the Military Services. Subject: Elimination of the 1994 Direct Ground Combat Definition and Assignment Rule.

[2] Mabus, Ray, Secretary of the Navy. May 2, 2013. Memorandum for the Secretary of Defense thorugh the Chairman of the Joint Chiefs of Staff Acting Under Secretary of Defense (Personnel and Readiness). Subject: Department of the Navy Women in the Service Review Implementation Plan.

[3] Amos, James, Commandant of the Marine Corps. 2014. "Marine Corps Force Integration: Much Remains To Be Done." *Marine Corps Gazette*. Jul. 2014.

[4] MARADMIN 493/14. Sep. 30, 2014. *Announcement of Change to Assignment Policy for Primary MOS 0803, 0842, 0847, 2110, 2131, 3146, 2149, 7204, and 7212*.

[5] Devilbiss, M. C. 1990. *Women and Military Service: A History, Analysis, and Overview of Key Issues.* Air University Press, Maxwell Air Force Base, Alabama. AD-A229 958.

[6] Stremlow, Mary V., USMC Reserve. 1986. *A History of the Women Marines, 1946-1977.* History and Museums Division, Headquarters, U.S. Marine Corps. PCN 19000309400.

[7] Rosenau, William, and Melissa McAdam. Oct. 2014. *The Integration of Female Marine Pilots and Naval Flight Officers, 1990-2000.* CNA Corporation. DRM-2014-U-008503-Final.

[8] *Public Law 112-239, National Defense Authorization Act for Fiscal Year 2013*. Jan. 2, 2013.

[9] ALMAR 012/12. Apr. 24, 2012. *Assignment of Women to Ground Combat Units*.

[10] Marine Corps Order 1200.17E. Aug. 2013. *Military Occupational Specialties Manual*.

[11] Hosek, Susan D., Peter Tiemeyer, M. Rebecca Kilburn, Debra A. Strong, Selika Ducksworth, and Reginald Ray. 2001. *Minority and Gender Differences in Officer Career Progression.* RAND Corporation. MR1184.

[12] United States Naval Academy (USNA) Instruction 1301.5F. Jul., 29, 2014. *Midshipmen Service Assignment*.

[13] Sutphen, Ben, and Jennifer Schulte, email discussion between Capt Sutphen, Marine Corps Recruiting Command, and Jennifer Schulte, CNA Corporation, about officer recruit qualifications for aviation and logistics occupations, Nov. 24, 2014.

[14] Baisden, Annette G. 1992. "Gender and Performance in Naval Aviation Training." Naval Aerospace Medical Institute, Accessed Feb. 13, 2015. Defense Technical Information Center. http://www.dtic.mil/dtic/tr/fulltext/u2/p006957.pdf.

[15] Boyd, Anna E. 2003. "Analysis of Determination of Student Pilot Success for United States Naval Academy Graduates." Naval Postgraduate School.

[16] Parcell, Ann D., and Martha MacIlvaine. 2005. *Naval Flight Officer Attrition.* CNA Corporation. CAB D0011671.A2/Final.

[17] Parcell, Ann D., Apriel K. Hodari, and Robert W. Shuford. 2003. *Predictors of Officer Success.* CNA Corporation. CRM D0007437.A2/Final.

[18] Kraus, Amanda, Ann D. Parcell, David L. Reese, and Robert W. Shuford. 2013. *Navy Officer Diversity and the Retention of Women and Minorities: A Look at the Surface Warfare and Aviation Communities.* CNA Corporation. DRM-2013-005306-Final.

[19] Headquarters Marine Corps, United States Marine Corps. "FY13 Command's Career-Level Education Board (CCLEB) Out-brief and Board Statistics." Sep. 10-24, 2012.

[20] Keating, Col Thomas. "FY13 Commandant's Professional Intermediate-Level Board (CPIB) Out-brief." Headquarters Marine Corps, Quantico, VA, Oct 17, 2012.

[21] Schulte, Jennifer, and Michelle Dolfini-Reed. Jun. 2012. *Prior-Service Reserve Affiliation and Continuation Behavior, Volume 1: Affiliation.* CNA Corporation. DRM-2012-U-000617-Final.

[22] Quester, Aline. 2010. *Marine Corps Recruits: A Historical Look at Accessions and Bootcamp Performance.* CNA Corporation. CAB D0023537.A1/Final.

[23] Peterson, Jeff, Aline Quester, Robert Trost, Catherine Hiatt, and Robert Shuford. 2014. *An Analysis of Marine Corps Female Recruit Training Attrition.* CNA Corporation. DRM-2014-U-008824.

[24] Quester, Aline, Laura Kelley, Cathy Hiatt, and Robert Shuford. 2008. *Marine Corps Separation Rates: What's Happened Since FY00?* CNA Corporation. CAB D0018759.A2/Final.

[25] Quester, Aline, Anita Hattiangadi, Gary Lee, Cathy Hiatt, and Robert Shuford. 2007. *Black and Hispanic Marines: Their Accessions, Representation, Success, and Retention in the Corps.* CNA Corporation. CRM D0016910.A1/Final.

[26] Peterson, Jeff, Jared Huff, and Aline Quester. 2013. *The Role of the Delayed Entry Program in Recruiting the All-Volunteer Force.* CNA Corporation. DRM-2013-U-005418-Final.

[27] Marine Corps Order P1400.32D Ch.2. Jun. 14, 2012. *Marine Corps Promotion Manual, Volume 2, Enlisted Promotions.*

The CNA Corporation

This report was written by CNA Corporation's Resource Analysis Division (RAD).

RAD provides analytical services—through empirical research, modeling, and simulation—to help develop, evaluate, and implement policies, practices, and programs that make people, budgets, and assets more effective and efficient. Major areas of research include health research and policy; energy and environment; manpower management; acquisition and cost; infrastructure; and military readiness.

DRM-2014-U-008649-1Rev

CNA Corporation is a not-for-profit research organization
that serves the public interest by providing
in-depth analysis and result-oriented solutions
to help government leaders choose
the best course of action
in setting policy and managing operations.

Nobody gets closer—
to the people, to the data, to the problem.

CNA
ANALYSIS & SOLUTIONS

www.cna.org • 703-824-2000

3003 Washington Boulevard, Arlington, VA 22201